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An interaction analysis model to study knowledge construction in xMOOCs

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ABSTRACT

One of the recent tools of online teaching and learning has been MOOC which utilizes the web and can be considered a critical factor in delivering future lessons. Coursera is an approved and famous online learning tool established by two professors from Stanford. According to previous studies, Coursera concentrates on duplicating knowledge instead of constructing it. The present work aims at observing Coursera community in its normal context and investigating how participants construct knowledge. The required data were gathered through archive data including the top and chosen posts of online discussion groups. The interaction analysis model (IAM) was used to qualitatively analyze the data. In the observed courses, it was found that Coursera is mostly at Phase I (sharing/comparing information) of the IAM. Using the IAM which was first proposed for investigations of online debates, the research found a new phase and operations for assessing the level of knowledge construction in online discussion forums. This research bridges the gaps in the related literature by providing a foundation for understanding knowledge construction in the xMOOC context. Besides, this research developed understanding for future work which is a Coursera community framework that generally makes a MOOC community more potential to construct knowledge.

I. INTRODUCTION

During the previous recent years, with the advent of Information and Communication Technology (ICT) which have been widely applied, the educational systems have been influenced and occasionally changed dramatically [1]. MOOCs are among the most recent technologies of remote learning, emerging as a result of changes in delivery of educational materials. From 2008 onward, different universities, particularly in North American context have started to run online education systems [2]. Such systems grew slowly from 2010 to 2012 when they began to be known as "MOOCs" [3] (see Fig. 1). Many definitions of MOOCs can be found in literature review, a summary of these definitions was provided in our previous work [4]. For instance, according to Yuan and his collaborators [5], Dave Cormier [6] proposed MOOCs for the first time in 2008 to provide a description of "connectivism as well as Connective Knowledge" courses used by Siemens and Downes [7], MOOCs were principally aimed at opening the education up and providing free accessibility to educational materials at the university level, so that different students could benefit education [5]. Despite online courses of conventional universities, these courses possess two main characteristics which are (1) Open accessibility, which means that everyone is capable of participating in online courses with no charge and (2) Being scalable, which means that an unlimited population of users can be supported by the courses [8].

The big population of online learners in MOOCs necessitates presence of some media to make interactions among learners and instructors possible. Discussion frameworks have been designed to meet this requirement [9] and seem to be necessary for efficient online courses, providing the central components of non-synchronous communications [10]. These frameworks can be considered as the shared attributes of online courses, making communication possible among all the users irrespective of the time or distance [11].

Accordingly, these communication and learning tools help learners to interact and engage in the related context easily and conveniently [10], while they are capable of sharing and acquiring new experiences and/or knowledge [12].

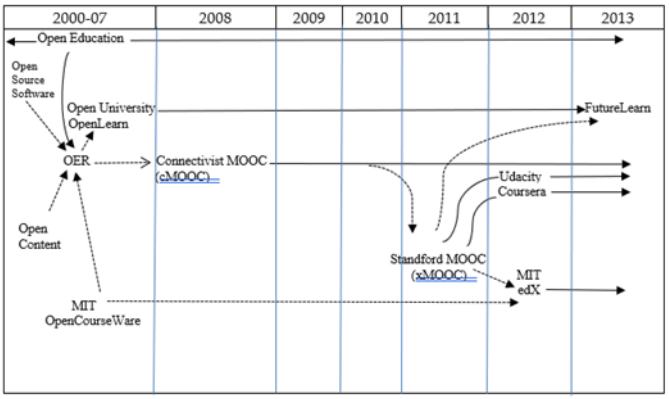


Fig. 1. MOOCs and open education timeline [9]

It means that a population of learners as well as educators will construct knowledge through interacting in the social context and sharing experiences and knowledge [13], resulting in a process known as "collaborative learning". MOOC discussion frameworks make the basis of interactions and are assumed to prepare the underlying ground to construct knowledge through collaboration in learning. When the group members interact together effectively and learn from each other, the next steps they go through could be forms of higher mental functions which are described in Interaction Analysis Model (IAM).

Establishment of a learning context to construct knowledge is possibly the target of all educational systems [14]. Constructing knowledge has been defined as the objective of collaborative learning in different research works [13]–[20]. According to Garrison [14], the collaborative concept is focused on the creation of a society of research in which learners are completely involved in collaborative construction of relevant and valuable knowledge. Whereas xMOOCs work according to conventional kinds of classroom context, cMOOCs use an experimental framework for novel schooling out of the classroom context, and accordingly function on progressive boundaries of higher education [8]. Two prevalent kinds of MOOCs include cMOOC and xMOOC. Here, "x" comes from edX and MITx as two kinds of MOOCs [21]. An online course called "Introduction to Artificial Intelligence" and introduced by Sebastian Thrun and Peter Norvig at the Stanford University in 2011 led to this branch [3]. A population of 160000 students was interested in AI-Stanford which is regarded an xMOOC which has been recently taken into consideration by the media. On the other hand, "c" refers to the word "Connectivism" that concentrates on the connection and collaboration associated with the learning [8]. In this regard, a group of like-minded users make up the courses with comparatively no organizational restrictions [8]. The two types are mainly different in terms of duplicating or constructing knowledge [22].

Constructing collaborative knowledge has been considered by Hmelo-Silver [23] as an important element in collaborative learning using computers. According to his explanations, different scholars have pointed to socio-cultural theories concentrating on the analysis of discourse with the aim of understanding the learning and significance of instruments used to facilitate construction of knowledge [24]–[27]. As Vygotsky [28] puts it, knowledge construction comes along with social actions as well as interactions. According to Hmelo-Silver [23] discussions among the learners should be understood along with the instruments facilitating their learning, so that construction of collaborative knowledge is understood as well. Several scholars are cited by him in the field of conducting research on this kind of learning methods with the use of different strategies including discourse analysis, ethnographic studies as well as various qualitative techniques [29]–[31].

II. METHODS

A. Research Design

Qualitative research design was employed in the present study, since examining the nature [32]. The Coursera community consisting of the users' interactions in discussion groups was examined using a netnographic procedure to find out the way through which construction of knowledge takes place in xMOOCs. This procedure is required to examine the status of knowledge construction in Coursera's discussion groups as it considers online communications in the form of social interactions rather than just content, which means its emphasis on the context [33]. The followings are the major phases included in ethnographic procedure: selection of site and entrée, ensuring ethical research, community observations and collection of data, analysing the collected data and iterative interpretations, and finally evaluations.

As mentioned in our previous paper [34] Coursera was selected as the site for this research which is an active site, with recent and regular communication and is also interactive so it contains participants' communications. Coursera is heterogeneous because it has a number of different participants with different ages, cultures and languages from all over the world.

According to our prior study [35], Kozinets' [36] method was taken into account to deal with possible ethical issues in the present work. Several processes are considered by Kozinets in dealing with ethical issues of ethnographic procedure [36], including identification of yourself and informing about your work, asking for permission, obtaining consent, citing and crediting cultural members.

B. Data Collection

After addressing the research ethics, data collection commenced. In this research, and due to its nature as a netnographic study, the quantity of objects and events is not clear from the start of the study. Instead, according to the concept of saturation, data collection was continuously done until the data saturation occurred.

Direct copies of the previous discussions with the members (archival data) were used to collect the required data which started on April 22nd, 2013 (when the researcher enrolled in a Coursera course) and finished on April 28th, 2014 (when the third course finished and the data saturation was obtained). Over the study period, the researcher participated in some activities such as watching video

presentations, completing homework tasks, quizzes as well as exams, having visits from online context of Coursera, taking part in discussion groups and having interactions with others in and out of the Coursera community.

The researcher selected the course "Learn to Program: The Fundamentals" for the first round of data collection due to the researcher's background in software engineering and an interest in programming. During this round of data collection, archival data for the first course was collected from the "Beginners Study Group" created by the course's teacher assistant. This was a common group with the highest points given by learners. Discussions in this group could be anything such as greetings, experiences, points of view and asking and answering questions. This round consisted of 336 posts of the "Beginners Study Group" in the "Learn to Program: The Fundamentals" course. The researcher copied these posts into a folder in the NVivo sources section as archival data.

A second round of data collection was launched when the researcher enrolled in the "Critical Perspectives on Management" course and participated in classes from 13 January 2014 until 17 March 2014. The decision about enrolment in this course was based on the available course start dates and the researcher's background in management and MBA courses. The participants in these three courses are from different levels with different backgrounds and experiences and detecting the participants' level was complicated. Besides, the level of study was not important factor in our study.

To gather the archival data, the researcher searched the forums and observed the most active forums and members. In the second course forums, there was a group of active learners who were creating a weekly post regarding each week's discussion. For example, "week 1 study questions - discussion" was one of these discussions. The researcher identified this group as the most active group and most appropriate sample for the study.

In this research, and due to its nature as a ethnographic study, the quantity of objects and events is not clear from the start of the study. Instead, according to the concept of saturation data collection was continuously done until the data saturation occurred. At the end of the second round of data collection and analysis, saturation was not reached and, consequently, the data collection was continued for another round. The selection of courses was based on the availability of courses and author's background to take participation in that courses.

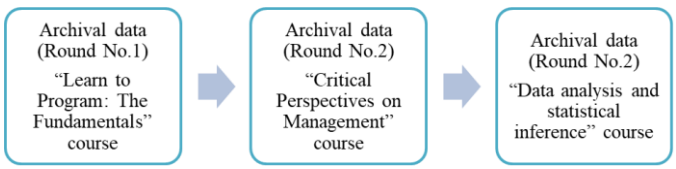


Fig. 2. Data Collection Rounds

For the third round of data collection, the researcher took an opportunity to observe an online course offered by Coursera which was also taught in the UTM data mining course as a part of an evaluation process for students. The "Data Analysis and Statistical Inference" course was taken which was used as a part of the "Data Mining" course in the Faculty of Computing. In order to observe discussions among these students and as an enhanced version of what was planned in the second round of data collection, a study group was created in the discussion forum entitled "Malaysian study group". This was done to direct the discussions to a particular forum for an easier and more focused observation and analysis. The data in the third round of data collection consisted of the discussions in this study group. Fig. 3 presents a schematic of the data collection rounds.

C. Data Analysis

When data were collected, their organization and coding were followed. Data was analysed using NVivo and IAM was also employed for data coding. Netnographic procedure has two kinds of data analysis, including analytic coding and hermeneutic interpretation [36]. The first one includes coding, noting, creating abstracts and making comparisons, checking and refining [36]. The second type includes more profound meanings of the messages and explanations rather than descriptions [36]. The data along with the researcher's previous theoretical perception regarding the subject under investigation will lead to establishment of themes, extraction of which was carried out through in-depth reading and looking for similar as well as different items along with systemic comparisons over data units.

Data collection and analysis in this research were bound together and were done concurrently. To have a structured focus on the subject of study and in order to avoid straying in the high volume of data, this research employed a theoretical lens.

In order to code the archival data, the researcher drew on the components of the theoretical framework, namely, the IAM. The researcher followed the deductive approach. While doing so, the researcher applied the IAM theoretical lens in order to better understand the state of knowledge construction in the Coursera MOOC. After coding, the coding was analysed and discussed with a specialist in qualitative research. The recoding process was carried out on the basis of agreement. This was done to test the code. In this study, the researcher analysed the data by reference to the researcher's own understandings, in light of the researcher's background, experiences and social context and with consideration of the context of this community. Certainly, another researcher would conduct this study in a different way and the findings would be different because of their different experiences and understandings [37].

As discussed in theoretical framework, the IAM can be used to investigate whether or not knowledge is being constructed by interactions among participants in a group [38]. Using this model, the discussion forum posts were analyzed. The analysis focused on understanding whether any form of new knowledge was being constructed in the community or if

the forum was only a platform for knowledge sharing whereby the outcome was not linked to some sort of new knowledge which did not exist among the participants already. To this end, the discussions that occurred in the forums were mostly observed, labeled and mapped to one of the five IAM phases. These phases start from sharing/comparing, through to dissonance, negotiation/co-construction, the testing of tentative construction of knowledge and finally reach the top level which is agreement statement/applications of newly-constructed meaning. The first stage in the IAM is the sharing/comparing of information, and the model progresses to the fifth phase which is agreement statement(s)/application of newly constructed meaning (see Fig. 4). If the discussions start at the first phase and progressively lead to the fifth stage, it means that knowledge is being constructed in the community. Otherwise, it would not be correct to claim that knowledge construction was occurring in a particular community.

Analyses have indicated the level of constructing knowledge. As an instance, in the case of mapping a lot of discussions in Phase V, it would be possible to construct knowledge. IAM starts with lower level mental activities including information share and comparison. Then it goes over phase II which is dissonance to higher levels of mental activities through phase III that consists of meaning negotiation as well as knowledge construction, and then phases IV and V will follow [38].

Guba's [24] model along with Krefting's [39] techniques were employed in the present study for evaluation of the outcomes. Accordingly, research reliability that can be considered equal to validity in quantitative studies will be ensured. Prolonged involvement, member checking, peer examinations and coding-recoding were the techniques employed in the present study.

III. Results and Discussion

A. Present Phase of Knowledge Construction

The IAM argues that interactions towards knowledge construction are happening in five phases (as discussed in theoretical framework) with the fifth being the final phase which is agreement statement(s)/applications of newly-constructed meaning. To investigate interactions in Coursera forums, messages were taken as the unit of analysis. Generally, most posts were coded at Phase I: Sharing/comparing of information (487, 37.90%) followed by Phase II: The discovery and exploration of dissonance or inconsistency among ideas, concepts or statements (34, 2.65%). This was followed by Phase III: Negotiation of meaning/co-construction of knowledge (18, 1.40%). No messages were coded at Phase IV and Phase V (see Fig. 5). At the end, 16.11% of the posts did not fit any of existing phases and were coded as new operations separately. This is a common practice with newly emerged codes and has been done in other research in the literature (such as Hou et al. [40] and Paulus [41]). More discussion about these newly emerged operations is given in the following sections.

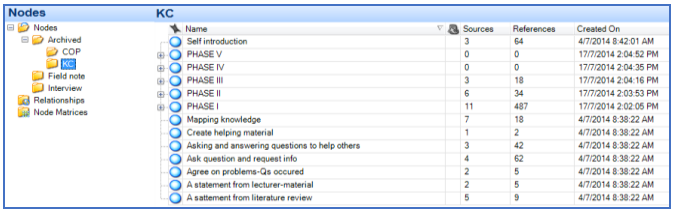


Fig. 3. Screenshot of NVivo Showing Nodes Under KC Category in Nodes Section

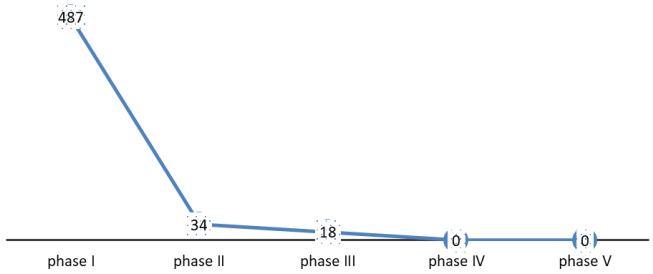


Fig. 4. The Number of Coding Occurrences in Each Phase of IAM

Phase	Operation/ sub sections	Description	Example
Social dimension	self-introduction	This kind of post as self-introduction shows how members' brief introductions could connect them with others in the same situation and create a network of people with the same interest, culture, and language in order to have more interactions.	"Hello friends, Look, I'm Brazilian and beginner in programming."
Phase I	Asking questions and requesting information	This shows how the discussion forum operates as an environment for members to share their issues and ask others to solve the issues through discussing them with each other.	"Can someone tell me 'What is a stratified sampling', I'm still not getting it." "What is the meaning of variability of residuals?"
Phase I	A statement of referral to the literature review, website, or any relevant source to illustrate point of view		
	Knowledge	Knowledge	"According to

Phase	Operation/ sub sections	Description	Example
	mapping	mapping is an effective way to provide more sources regarding a discussed subject and link it to more references.	enotes.com, a free-market economy is driven by individual innovation and the notion that hard work and ingenuity will be rewarded by success."
	Creating and sharing helping material by learners	In this way, members can benefit from others' efforts and learn to share ideas and any helping materials for others to use.	"Person A prepared a summary for reading Roman Grain Trade in this thread:
	Referral to the course materials	Within the discussions, some posts referred members to the video lectures or resources for the course.	"Also, in Lecture 1, it was noted that a market characterized by direct face-to-face transactions between participants, it has good information flow."
	Referral to the literature review	References to relevant literature for some of the terms in the related course can be found in the discussion forum posts. Following the discussion enables members to learn about others' knowledge domain and their sources. In addition, it increases members' knowledge in that area. Having knowledge about other related sources could initiate constructive and thoughtful discussions among members.	"For reputation, the following definitions and examples were found. Various parties are enabled to build reliable and cooperative relations through reputation (M.Greco et al., 2010).

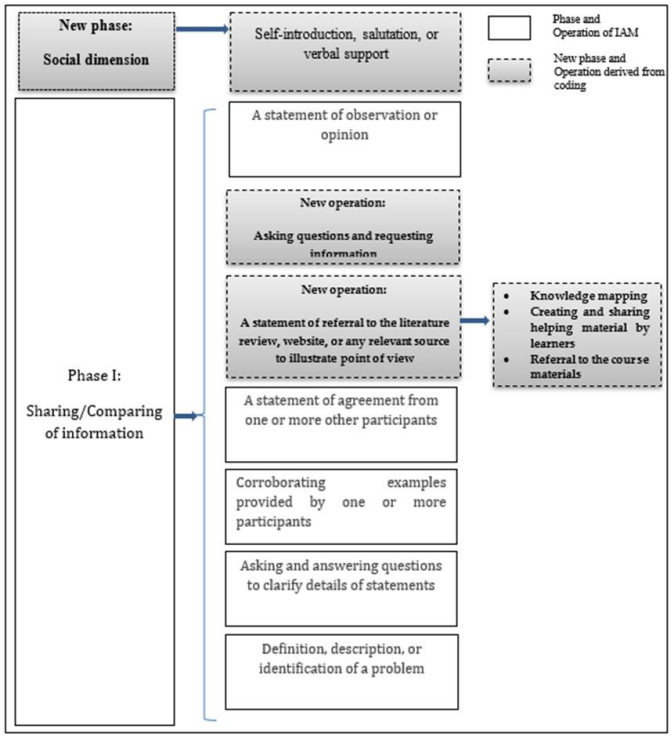


Fig. 5. New Phase and New Operations for Analysis of Interactions in xMOOCs

The new phase of Social dimension contains "self-introduction" operation which was designed for learners to introduce themselves to each other. Henri's typology offers a useful ordering from social through cognitive to meta-cognitive processes in online learning environments [42]. The social dimension is defined by Malliris as "a statement or part of statement relating to formal content of subject matter such as self-introduction, verbal support and statements of feeling" [43]. Thus this new phase was added to IAM as Social dimension phase. For example, in the researcher's observations of the discussions in the Coursera discussion forum, there was a surprising number of posts in the discussions that were characterized as personalized communication within the Coursera community. Members were interested to introduce themselves in discussion forum posts. The "self-introduction" category was created for this kind of post in discussions and interactions.

Furthermore, the new operation of "A statement of referral to the literature review, website, or any relevant source to illustrate point of view" also contains these categories: Knowledge mapping, Referral to the literature review, Referral to the course materials and creating and sharing helping materials. All of these categories include messages as referral to other sources to clarify points of view. This new operation is missing in IAM because of its debate nature whereas in discussion forum context these kinds of messages happen to share any related sources with the aim of sharing, not negotiating, which appears in phase I.

B. Movements Between Phases

There is movement between operations of phases. In other words, the boundaries between different operations and phases are sometimes not clear in posts. In addition, different operations sometimes occur in a single post. Such cases were observed in this study and there were some posts that could be coded under several operations and even more than one phase. For example, the messages presented next in this section showed movement from Phase II/A to Phase III/D, from Phase I/B to Phase I/C and then to Phase III/D, from Phase I/B to Phase I/C and then Phase I/A. There are more examples for showing movement between the steps of the phases but just a few examples are given to show how the steps of the phases are related to each other and move from one step to another step.

The next post moved the discussion through Phase II to Phase III to suggest a new proposition. At first, the member mentioned a kind of disagreement with one of the other members who mentioned the self-reinforcing positive-feedback loop as an answer. Afterwards, the member stated the answer should be a strong government. The new proposition asked the community to consider whether government should establish laws for any market-driven society (see Fig. 7).

"Even with a self-reinforcing loop, there has to be a starting point of the action. I would say that it has to be a strong government that allows for businesses to start and to thrive. Phase II/A

The government has to establish laws and the basic procedures for any market driven society. Once the markets are up and thriving they can then work on their own rules and procedures within the umbrella of an overhead government. Without the protection of the government traders would not be able to expand the market reach and start new markets. Phase III/D".

The next post moved the discussion through Phase I to Phase III to suggest a new proposition. At first, the member mentioned a kind of agreement with one of the other members. Afterwards, the member explained it and provided new examples. The member tried to move the discussion from Phase I/C to Phase III/D by suggesting a new proposition (see Fig. 8).

"Lots of interesting replies so far. I think that on question 3, especially, I agree with Henry. Oil is definitely the first thing that came to my mind when I read the question. Phase I/B

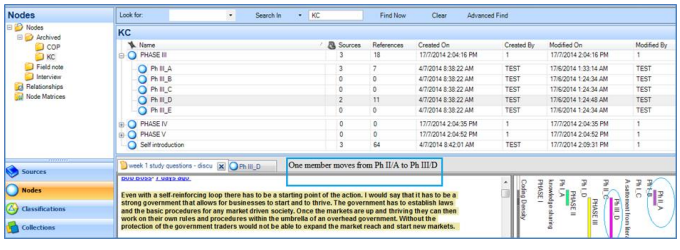


Fig. 6. Screenshot of NVivo showing an example of movement in the discussion through Phase II to Phase III

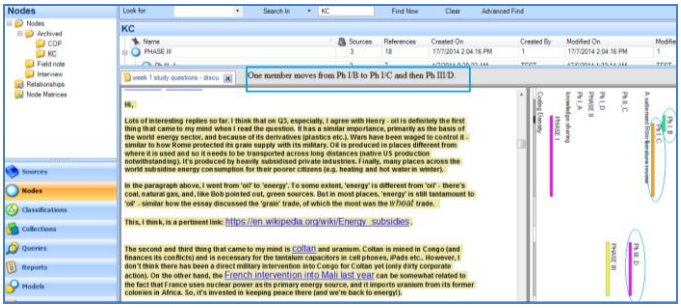


Fig. 7. Screenshot of NVivo showing an example of movement in the discussion through Phase I to Phase III

It has a similar importance, primarily as the basis of the world energy sector, and because of its derivatives (plastics etc.). Wars have been waged to control it. Similar to how Rome protected its grain supply with its military. Oil is produced in places different from where it is used and so it needs to be transported across long distances (native US production notwithstanding). It's produced by heavily subsidized private industries. Finally, many places across the world subsidize energy consumption for their poorer citizens (e.g. heating and hot water in winter).

In the paragraph above, I went from oil to energy. To some extent, energy is different from oil. There's coal, natural gas, and, like Bob pointed out green sources. Phase I/C

But in most places, 'energy' is still tantamount to oil - similar how the essay discussed the grain trade, of which the most was the wheat trade.

I think, this is a pertinent link: https://en.wikipedia.-org/wiki/Energy_subsidies.

The second and third things that came to my mind are Coltan and uranium. Coltan is mined in Congo (and finances its conflicts) and is necessary for the tantalum capacitors in cell phones, iPads etc. However, I don't think there has been a direct military intervention into Congo for Coltan yet (only dirty corporate action). On the other hand, the French intervention into Mali last year can be somewhat related to the fact that France uses nuclear power as its primary energy source, and it imports uranium from its former colonies in Africa. So, it's invested in keeping peace there (and we're back to energy!). Phase III/D

Relevant links:

http://www.world-nuclear.org/info/Country-Profiles/-Others/Uranium-in-Africa/

http://www.world-nuclear.org/info/Country-Profiles/-Countries-A-F/France."

The next post moved the discussion through the operations of Phase I. At first, the member mentioned agreement with one statement. After that, the member provided examples from their own experiences and then stated their opinion about the mentioned topic (see Fig. 9):

"I agree that collaboration is the key missing link in many set-ups where people work from home and that is something that is different in the Roman Grain Trade example. Indeed it

varies from job to job. There will be some roles that don't involve a lot of collaboration within or across teams but where they do exist there need to be tools to manage that. Phase I/B

I say this as someone who works from home every day. We have no central office and have staff in 3 countries (and 3 time zones) as a result. The company has worked this way for nearly a decade and it's been fine but in the last year have found that there are some key points in the lifecycle of our projects where meeting face to face is beneficial. Sometimes through communication in face to face, you get a better read on people's body language and being in the same room as them. Phase I/C

In terms of an evaluation system I don't know how well eliminating managerial bias works; it depends who is doing the assessment and how rigorous the mediation of that is. Phase I/A"

C. *Overall Results*

A number of reasons could account for the results of this part of study. First, the most common activity was sharing and comparing information. The members from different countries participated in a discussion forum to ask their questions and exchange opinions about the course material. They stated their opinions or observations and showed their agreement with other statements. They provided examples to support their claims. Furthermore, they asked and answered questions to clarify the detail of statements. They also identified the problems. Second, criticizing each other may not be acceptable behaviour in some cultures, but in this community with various cultures it occurred sometimes. Members identified and stated the areas of disagreement. Then they asked and answered questions in order to clarify the disagreement. In addition, they tried to support their statements with references to the literature, experiences and collected data. Third, the negotiation of meaning and co-construction of knowledge occurred, but only in the operations of negotiation/clarification of the meaning of terms and proposal of new statements. Phases IV and V were not demonstrated in this community, reflecting that higher phases of knowledge construction are difficult to achieve. Moreover, Phase III can be seen as a pre-requirement for these two phases. Phase IV contains activities to test and modify the proposed synthesis. Indeed, it requires some synthesis to test which has to be created in Phase III. After testing, Phase V contains activities to summarize the agreement and then apply new knowledge. At the end, participants illustrate their understanding that their knowledge and ways of thinking have changed as a result of the discussion. Fig. 10 shows the occurrence of coding based on the coding categories. Fig. 11 shows the screenshot of NVivo showing the number of codes in each step of the knowledge construction phases.

D. *Discussion*

As seen in the discussions above, very little can be found in the literature on the question of assessing knowledge construction in MOOCs. Some researchers argue that knowledge is not constructed in xMOOCs such as Coursera [7], [21], [31], [44]–[46] but there is not any research to study xMOOCs to understand the state of knowledge construction. In this paper, the present phase of knowledge construction was assessed through Gunawardena et al.'s [38] IAM. This model can be applied to observe the interactions in discussion forums and investigate whether or not knowledge is being constructed based on the interactions in the discussion forum. As mentioned the IAM argues that interactions towards knowledge construction occur in five phases. Overall, most of the posts in the Coursera discussion forums were coded in Phase I (487 posts, 37.90%) followed by Phase II (34 posts, 2.65%) and Phase III (18 posts, 1.40%). Interestingly, no messages were coded in Phase IV and Phase V which are the phases that show knowledge construction. Fig. 12 illustrates the distribution of knowledge construction phases found in this study. The result of this study cannot be generalized because there is a large volume of data available online and our study limited the data and the number of participants and the researcher's time in the field.

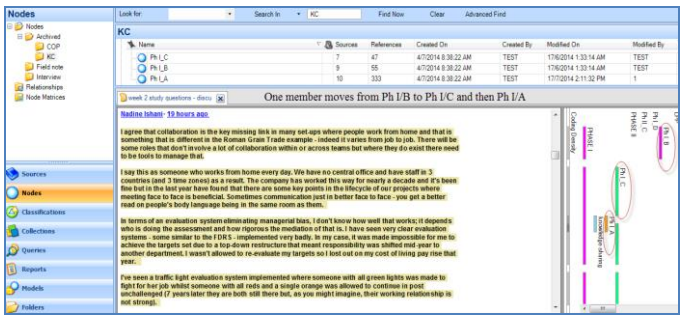


Fig. 8. Screenshot of NVivo showing an example of movement in the discussion through the operations of Phase I

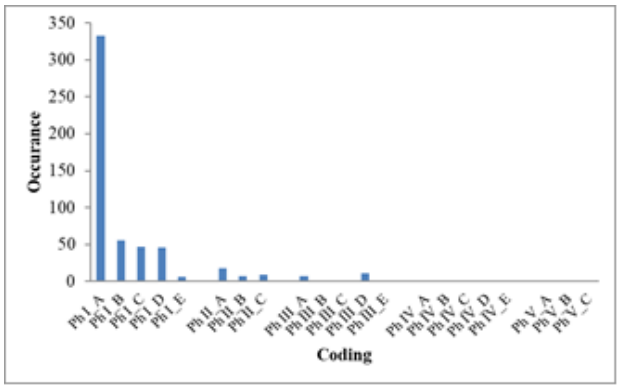
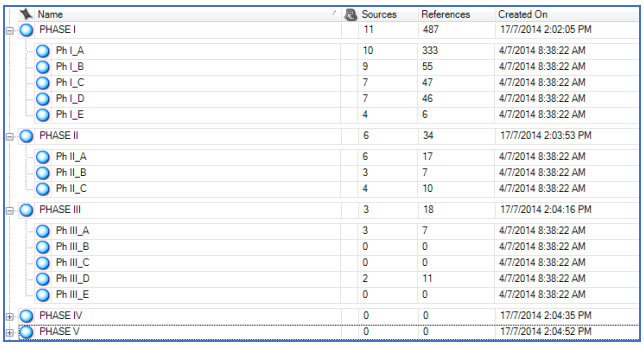


Fig. 9. Bar chart for coding occurrence



Name	Sources	References	Created On
PHASE I	11	487	17/7/2014 2:02:05 PM
Ph I_A	10	333	4/7/2014 8:38:22 AM
Ph I_B	9	55	4/7/2014 8:38:22 AM
Ph I_C	7	47	4/7/2014 8:38:22 AM
Ph I_D	7	46	4/7/2014 8:38:22 AM
Ph I_E	4	6	4/7/2014 8:38:22 AM
PHASE II	6	34	17/7/2014 2:03:53 PM
Ph II_A	6	17	4/7/2014 8:38:22 AM
Ph II_B	3	7	4/7/2014 8:38:22 AM
Ph II_C	4	10	4/7/2014 8:38:22 AM
PHASE III	3	18	17/7/2014 2:04:16 PM
Ph III_A	3	7	4/7/2014 8:38:22 AM
Ph III_B	0	0	4/7/2014 8:38:22 AM
Ph III_C	0	0	4/7/2014 8:38:22 AM
Ph III_D	2	11	4/7/2014 8:38:22 AM
Ph III_E	0	0	4/7/2014 8:38:22 AM
PHASE IV	0	0	17/7/2014 2:04:35 PM
PHASE V	0	0	17/7/2014 2:04:52 PM

Fig. 10. Screenshot of NVivo showing the number of codes in each step of the knowledge construction phases

Based on the findings of an IAM analysis of three xMOOC courses, the interactions among participants in MOOCs do not focus on knowledge construction in the Coursera community and they are mostly focus on Phase I (sharing/comparing of information) of the knowledge construction process. From this we claim that higher phases of knowledge construction are not actually achieved in Coursera discussion forums. Since concepts can represent different meanings to different people with different knowledge and cultures, knowledge construction cannot be supported by this variation. Knowledge construction is achieved when people negotiate on concepts and reach an agreement on the newly constructed knowledge. Thus, the sharing/comparing of information (Phase I) was most encountered in the Coursera discussion forums. According to Lucas et al. [47] higher phases of knowledge construction are reachable if activities are designed in a way that is appropriate to the particular circumstances. Therefore, our future paper focuses on the Community of Practice (CoP) framework for identifying the structural elements of a developing community within Coursera MOOCs. Through the analysis of discussion forum posts, the practices and mechanisms that give form to the Coursera community were identified .Through exploring the structural elements of a developing community, the Coursera structured elements can be improved and consequently, the Coursera crowd can be advanced into a learning community. The Coursera Community Framework (CCF) will proposed to foster knowledge construction in Coursera's discussion forum based on the theory of CoP. Some of the amplifying features that help forming elements of CoP are: Active participation, voting mechanism, being free and global education, social networking sites, facilitative tools, Low-level conflict, highly focused discussion, netiquette, moderators and positive behavior (All of these features will discussed in our next paper).

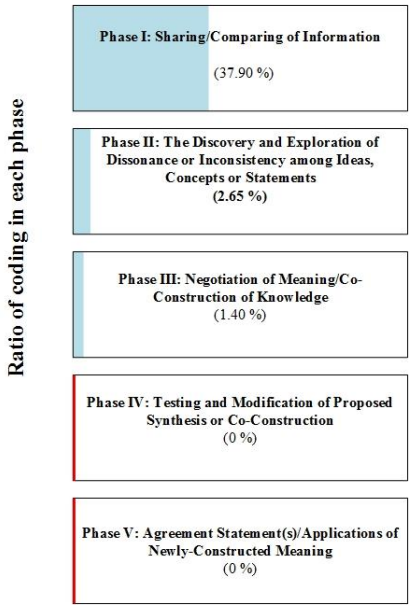


Fig. 11. Distribution of knowledge construction phases in Coursera discussion forums (based on Gunawardena et al.'s [47] IAM)

Some posts could not be coded to the operations of the IAM. Thus, new categories were identified and these were tagged for the purpose of assessing the level of knowledge construction in Coursera discussion forums. The IAM, which was originally proposed to assess the level of knowledge construction in debate, does not cover these new categories. The new categories are added to the IAM and enable the model to be applied to analyze discussion forum posts. These new categories are as follows: New phase: "Social dimension" phase with operation of "Self-introduction"; New operations: "Asking questions and requesting information" and "A statement of referral to the literature review, website, or any relevant source to illustrate point of view". This operation contains emerging categories from data analysis including Knowledge mapping, Referral to the literature review, Referral to the course materials and creating and sharing helping materials.

IV. Conclusion

Based on literature review, construction of knowledge was illustrated in MOOCs. Moreover, there were doubts and questions regarding the concept of community. As an example, Gaebel [35] has pointed out that Coursera is not able to build a learning community and can just establish a group of users. This issue will be addressed in our next study. Although it is clear that Coursera does not have the potential to build knowledge as an xMOOC, this paper explores the current state of knowledge construction in Coursera's discussion forums in order to study its ability to be a CoP in which knowledge construction could take place. Discussion forum in Coursera is only place that participants can connect and discuss. The major aim of this research is studying Coursera (as a common xMOOC with a large number of learners who have less knowledge in technical subjects and are able to participate in this type of MOOC because it is open for anyone to participate) to provide a foundation for further study on fostering knowledge construction. In fact, the aim of any educational system particularly for xMOOCs, which are popular among learners of different levels of knowledge, is to create a learning environment where knowledge is created. Examination of the status of constructing knowledge in Coursera discussion groups was carried out according to the archival data and by the use of IAM in order to obtain this goal. Accordingly, it was found that participants' interactions across Coursera do not probably direct them toward comprising and synthetizing along with subsequent testing of the synthesis. It was supposed that they primarily use the share or comparison of information over the process of constructing knowledge. Regarding the analysis of the level of constructing knowledge in discussion groups, new phases as well as functions were discovered for IAM employment, which can be added to it in the assessment of knowledge construction in MOOC discussion groups. The in-depth discussions which were provided before indicate the limitations that Coursera discussion groups impose on users considering achievement of higher phases in construction of knowledge. It was also found that information share and comparison which was included in the first phase had the highest use in the Coursera discussion groups. Indeed, these forums made the following steps of co-constructing more challenging, whereas the highest number of

postings could be observed in the first phase with insignificant cases of arguments which could move the discussions to the fourth and fifth phases. The results obtained in the present study may not be generalizable to other contexts, but considerable illustration of the Coursera MOOC is provided by them. Every person in the present work had his/her own attitudes as well as experiences in this regard, which made generalization of the results to the whole community more difficult.

Through the study of the knowledge construction process, the understanding of the researcher about the state of knowledge construction in Coursera discussion forums has been enriched. The findings strengthen the view that knowledge is not constructed in Coursera discussion forums. The findings of this study indicate that the Coursera discussion forum is at the information sharing phase and that knowledge construction does not occur. Proper operations should be put in place in order to analyze the interactions of discussion forums. Some new operations based on learners' interactions in discussion forums were identified and can be added to the IAM. Self-introduction operation as social dimension has not been included in IAM; in this study, it is considered as a new phase because it is in social category, and not interactive, cognitive or meta-cognitive categories as other phases are. In addition, new operation of "A statement of referral to literature, website, or any relevant source to illustrate point of view" was mapped to Phase I of IAM but as a new operation that IAM is missing. This operation contains these new emerged categories: Knowledge mapping, Referral to the literature review, Referral to the course materials, Creating and sharing helping material by learners. The operation of "Asking questions and requesting for information" is another new operation which is missing in IAM. Discussion forum is used to increase clarity and understand the issues; thus, it is common for members to start discussion with asking questions. Reliable foundations to understand the process of constructing knowledge in the Coursera are provided by the findings of the current study. Moreover, the basis is provided for the development of the Coursera community foundations to foster construction of knowledge in MOOC discussion groups by promotion of a community as a community of practice or as it is called CoP. Examination of this issue is carried out in our future work.

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