

# Pilot test for validation of an instrument of knowledge management in the massive open online context

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## ABSTRACT

Knowledge management<sup>1</sup> is a systematic process that deals with looking for, filtering, introducing and using information with the support of information technologies. The objective of using knowledge management depends on the sector that uses it. In companies, it is a value in the balance, in education it is a way to improve the successful of students. The massive open online courses (MOOC) are a topic in which it has been done little researching into the area of knowledge management. In this work, it will be presented a measurement instrument of knowledge management processes on MOOC. The model is based on a previous model used in business who has been adapted to the intercultural, massive and informal context of MOOC. The model was made with the help of an expert panel and its internal consistence was assessing with the Alpha Cronbach technique obtaining general scores over 0.9.

## CCS CONCEPTS

•Applied computing→Education→E-learning.

## KEYWORDS

MOOC; distance learning; E-learning; Measure instruments.

## 1 INTRODUCTION

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From the point of view of the knowledge management, knowledge can be perceived from three different ways: as a process, as an object or as a cognitive state [3, 13, 16, 18]. These different manners of perceiving the knowledge have important theoretical implications about their management. If knowledge is considered as an object, then objects can be stored and manipulated and knowledge management systems will be systems to store these objects. If on the contrary, knowledge is considered as a process managed by an expert, then knowledge management systems have to control the flow of this knowledge and ease its process of creation, distribution and sharing. Finally, if knowledge is considered as a cognitive process, then knowledge management systems must expose participants to potentially relevant and useful information and facilitate the procedures in order to improve the learning process of the participants.

The initial thought is that knowledge is stored as objects that must be manipulated in order to make the teaching-learning process easier for students. Therefore, our interest is far from considering the knowledge as an object and it is expected that it will be a process. In this process, the storage system and the student contribute in the teaching-learning task. On the other hand, if knowledge is considered as a cognitive process, an artificial intelligence system must provide the most valuable materials for the student. Although these systems have a great potential, different experiences have proved that they are impractical and hard to translate to other context [2]. In summary, the knowledge management will be treated from the perspective of the knowledge management process.

For the purpose of this work, it is assumed that knowledge management processes are divided in six sub-process: creating knowledge, capturing knowledge, organizing knowledge, storing knowledge, disseminating knowledge and applying knowledge [5, 6, 9, 15, 17].

The process of creating knowledge consists of the creation of new knowledge based on lectures, documents found in internet or talking near the coffee machine. The process of

capturing knowledge needs from someone capable of detecting the new knowledge that is important to the participants. The process of organizing knowledge requires of a system of classification or labeling the new knowledge, this system could be an automatic or manual system. The storing knowledge system draws from the labeled knowledge and stores it in an accessible format for all the participants. The process of disseminating knowledge is based on a system that gives to each participant the knowledge that they need. The process of applying knowledge gives the opportunity to the participant to apply the new knowledge to new situations.

In order to measure these knowledge management processes, Lawson [10] developed a survey called KMAI (Knowledge Management Assessment Instrument). This instrument, designed for a business environment, allows to a pertinent measure of knowledge management six sub-process. The test was validated using the answers from the workers of 120 business organizations, the validation process obtained a relevant factor of Alpha of Cronbach internal consistence value, it was upper than 0.8 for each one of the six dimensions. One of the current researches, far from Lawson design for the KMAI instrument, is the analysis of the knowledge management process in the on-line teaching environment and, in particular, in the case of MOOCs (Massive Open Online Course) [1, 11, 12]. For this reason, an adaption from the original KMAI instrument to the Spanish language and MOOC context was done. So, the main goal of this work will be the validation of this new version of the KMAI instrument.

Tree steps were followed in order to redesign the instrument. Firstly, a translation to Spanish and an adjustment to on-line teaching context was made bearing in mind the specificities of the MOOC courses. Secondly, it has been necessary to gather an experts panel on teaching on-line, MOOC and knowledge management with the purpose of identify the failures perpetrated in the first phase and point to aspects that can be improved. Finally, the third phase was a pilot study with the participants of a MOOC in order to assess the internal consistence of the new instrument.

## 2 CONTEXT

As previously it was said, that pilot was made on the MOOC platform MiriadaX “Basic steps for a personalized learning in the classroom”, (in Spanish: “Pasos básicos para un aprendizaje personalizado”). The course was made on May in 2017 and included the participation of 2459 people, of who 1123 started the course and 523 finished it. This result is an unbelievable 46% rate of success, with respect to the participants that started the MOOC (usually rate is below 10%).

In the design of this MOOC was not used any special strategy of knowledge management, the design responds to a xMOOC pattern [7, 8] provided by MiriadaX. In order to promote the socialisation of participants an external social network in Google+ was provided.

## 3 DESCRIPTION

For the elaboration of the new survey, as it was said, an expert panel was created. This panel was formed by prestigious researchers in the field of education, knowledge management and in the design of several MOOCs. The translation to the Spanish language of the KMAI instrument presented in Table 1 of Esteban-Escaño et al. work [4] was provided to the panel. This translation was adapted to the MOOC context. The original KMAI instrument is presented in Table 1.

**Table 1: Original version of KMAI**

G1	Creating knowledge
G1-A	My organization has mechanisms for creating and acquiring knowledge from different sources such as employees, customers, business partners and competitors.
G1-B	My organization encourages and has processes for the exchange of ideas and knowledge between individuals and groups.
G1-C	My organization rewards employees for new ideas and knowledge.
G1-D	My organization has mechanisms for creating new knowledge from existing knowledge and uses lessons learnt and best practices from projects to improve successive projects.
G2	Capturing knowledge
G2-A	My organization responses to employees' ideas and documents them for further development.
G2-B	My organization has mechanisms in place to absorb and transfer knowledge from employees, customers and business partners into the organization.
G2-C	My organization has mechanisms for converting knowledge into action plans and the design of new products and services.
G2-D	My organization has policies in place to allow employees to present new ideas and knowledge without fear and ridicule. The organization showcases new ideas from employees to other staff.
G3	Organizing knowledge
G3-A	My organization has a policy to review knowledge on a regular basis. Persons are specially tasked to keep knowledge current and up to date
G3-B	My organization has mechanisms for filtering, cross listing and integrating different sources and types of knowledge.
G3-C	My organization gives feedback to employees on their ideas and knowledge.
G3-D	My organization has processes for applying knowledge learned from experiences and matches sources of knowledge to problems and challenges
G4	Storing knowledge
G4-A	My organization utilizes databases, repositories and information technology applications to store knowledge for easy access by all employees
G4-B	My organization utilizes various written devices such as newsletter, manuals to store the knowledge they

	captured from employees.
G4-C	My organization has different publications to display the captured knowledge.
G4-D	My organization has mechanisms to patent and copyright new knowledge.
<b>G5</b>	<b>Disseminating knowledge</b>
G5-A	My organization has knowledge in form that is readily accessible to employees who need it. (intranets, internet)
G5-B	My organization sends out timely reports with appropriate information to employees, customers and other relevant organizations.
G5-C	My organization has libraries, resource center and other forums to display and disseminate knowledge
G5-D	My organization has regular symposiums, lectures, conferences, and training sessions to share knowledge.
<b>G6</b>	<b>Applying knowledge</b>
G6-A	My organization has different methods for employees to further develop their knowledge and apply them to new situations.
G6-B	My organization has mechanisms to protect knowledge from inappropriate or illegal use inside and outside of the organization
G6-C	My organization applies knowledge to critical competitive needs and quickly links sources of knowledge in problem solving.
G6-D	My organization has methods to analyze and critically evaluate knowledge to generate new patterns and knowledge for future use.

The final purpose of the new instrument will be the assessment of the knowledge management process perceived by the participants in a MOOC that employs a particular knowledge management system, i.e. a social network. For the research purpose, is hard to segregate the participants in MOOC in order to apply an experimental research methodology and get a control and experimental groups. For this reason, to obtain an assessment of the knowledge management conducted in previous MOOC a pre-test capable of measure the dimensions of the knowledge management process was made. The objective is the evaluation of the perception of enhancement in knowledge management on participants in a MOOC against their perception of previous ones. In this way, a comparison between previous experiences and the new one may be made. The pre-test and post-test must be different to avoid the contamination due to the administration of the pre-test. In the pre-test only one question per each dimension of the knowledge management process was included. The first translate to the Spanish and MOOC context with pre-test and post-test questions, can be found in [4].

After the revision work made by the expert panel, some changes were introduced in some questions. The result was the questionnaire which is showed in Table 2. This one was used in the pilot test administrated to the MOOC participants.

The Spanish version of the questionnaire can be found in [4].

**Table 2: Expert panel revised instrument**

<b>PRE-TEST</b>	
P1	The MOOC I have participated in had mechanisms to share ideas and knowledge between teachers and participants and between peers.
P2	The MOOC I have participated in had mechanisms to collect the ideas and suggestions of participants.
P3	The MOOC I have participated in, the section of knowledge contributed by participants had some kind of organization that helped me to find the information.
P4	The MOOC I have participated in had some kind of digital repository in which information supplied by teachers and participants was stored.
P5	The MOOC I have participated in you can access to the information on completion of the course.
P6	The MOOC I have participated in the information supplied in the course helps me to solve problems in my work.
<b>POST-TEST</b>	
<b>G1</b>	<b>Creating knowledge</b>
G1-A	This course has different mechanisms for creating and acquiring knowledge from different sources such as participants, faculty or external links.
G1-B	This course is designed to encourage and support the interchange of ideas and knowledge among participants.
G1-C	In this course, the participants are motivated to provide new ideas and knowledge
G1-D	I have perceived that the organization in this course has mechanisms to create new knowledge from the existent one and to present models based on acquired knowledge in previous editions in order to improve the learning in this course.
<b>G2</b>	<b>Capturing knowledge</b>
G2-A	The faculty of this course takes in account the participants ideas and support and guide their future development.
G2-B	This course has mechanisms for absorbing and converting the knowledge of participants and teachers in course resources-
G2-C	The course has mechanism for converting acquired knowledge in new knowledge in external environments to the course.
G2-D	The course has policies in place to allow participants to present new ideas and knowledge without fear and ridicule.
<b>G3</b>	<b>Organizing knowledge</b>
G3-A	In this course, the knowledge which is generated is revised frequently to keep it up to date.
G3-B	The course has mechanisms for filtering and linking different sources and kinds of knowledge.
G3-C	This course gives feedback to the participants about their ideas and knowledge.

G3-D This course has processes that let you use the knowledge learned from experiences and matches sources of knowledge to solve problems and challenges.

#### G4 Storing knowledge

G4-A This course gives an easy access to databases, repositories or other resources or tools to store the knowledge.

G4-B This course has resources to store the knowledge produced by participants.

G4-C This course produces different publications in social networks in the Internet to visualise the obtained knowledge.

G4-D This course gives information to participants about how to protect copyright and the physical device with the new generated knowledge

#### G5 Disseminating knowledge

G5-A The knowledge generated from this course is easily accessible

G5-B In this course mails and alerts are sent regularly with suitable information for participants.

G5-C This course organises the generated knowledge for its public access in Internet.

G5-D This course promotes wikis, chat groups, discussion forum, blogs participation or social network participation to share the knowledge.

#### G6 Applying knowledge

G6-A The course methodology let you apply the acquired knowledge to new situations.

G6-B This course has mechanisms of information to avoid the inadequate and illegal use of the generated knowledge in and out of the platform.

G6-C The knowledge acquired during the course will help me to solve troubles that I will need to handle in the future.

G6-D A methodology to participants has been supplied in order to analyse and assess critically the obtained knowledge.

The pre-test was provided to all the MOOC participants as a voluntary activity number one. 758 answers were obtained, but the ones of the participants that never had participated in a MOOC before, need to be discarded. At the end, 529 answers were recollected. The post-test was provided as the last activity of the course and 401 answers were collected.

In order to link the answers in pre-test and post-test, a numeric code or an e-mail was requested to the participants. These data were not compulsory for the participants and 192 answers with coincidence in these codes were collected. The data treatment was done with a Java program written by the authors for this purpose.

## 4 RESULTS

With the answers obtained in the pre-test and post-test it was made an internal consistence test by using the Alpha of Cronbach technique. This test cannot establish if a question in fact measures what it is intended to measure, this work belongs to the expert panel. The Alpha of Cronbach test

obtains a coefficient that is used to value the level in which every item of the same scale assesses a common concept to all of these items. The math of this coefficient is based on the mean correlation of each item in the scale with the rest. This coefficient is a number from zero to one, where a zero means a lack of internal consistence and one means the highest internal consistence value. In social sciences research, a value greater than 0.7 is taken as validated [14].

The results of the Alpha of Cronbach coefficient for the pre-test are showed in Table 3, whose first column is the question code. The second column (Alpha) represents the Alpha of Cronbach value of each question computed from the data variance. The third column (Std Alpha) represents the standardised Alpha computed from the data correlation. Finally, the fourth column (item, total) represents the correlation between the question and the total punctuation of the test. The absolute Alpha value for the test is 0.9506 and 0.9507 for standardised Alpha. In order to contemplate the validity of the test is necessary that the whole test, and every question, have an assessment in the standardised Alpha upper than 0.7. Due to these exposed reasons, the internal validity of the instrument has been proved.

**Table 3: Results in Alpha Cronbach pre-test**

Question	Alpha	Std Alpha	(item, total)
P1	0.9414	0.9414	0.8464
P2	0.9430	0.9430	0.8322
P3	0.9405	0.9405	0.8544
P4	0.9400	0.9401	0.8580
P5	0.9398	0.9402	0.8595
P6	0.9429	0.9432	0.8334

The same process was conducted with the post-test obtaining the results showed in Table 4, in which the columns have the same meaning than in Table 3.

**Table 4: Results in Alpha Cronbach post-test**

Question	Alpha	Std Alpha	(item, total)
G1-A	0.9434	0.9474	0.6903
G1-B	0.9439	0.9480	0.6388
G1-C	0.9434	0.9476	0.6743
G1-D	0.9434	0.9478	0.6667
G2-A	0.9444	0.9489	0.5883
G2-B	0.9443	0.9487	0.5922
G2-C	0.9434	0.9478	0.6662
G2-D	0.9433	0.9473	0.6992
G3-A	0.9439	0.9485	0.6372
G3-B	0.9434	0.9481	0.6649
G3-C	0.9432	0.9479	0.6767
G3-D	0.9429	0.9473	0.7181
G4-A	0.9430	0.9474	0.7035
G4-B	0.9429	0.9476	0.6992

G4-C	0.9438	0.9483	0.6336
G4-D	0.9448	0.9490	0.5894
G5-A	0.9441	0.9484	0.6159
G5-B	0.9456	0.9497	0.5260
G5-C	0.9447	0.9491	0.5709
G5-D	0.9442	0.9485	0.6058
G6-A	0.9428	0.9470	0.7265
G6-B	0.9456	0.9494	0.5514
G6-C	0.9438	0.9481	0.6335
G6-D	0.9429	0.9470	0.7316

In post-test case the absolute Alpha value for the whole test is 0.946 and Std Alpha 0.9502, columns in Table 4 have a value upper than 0.7 for Alpha and Std Alpha. For these causes, the internal validity of the instrument has been proved again. When an instrument has several internal dimensions, it is interesting to consider the internal consistence of each dimension. The results of this analysis for the post-test are presented in Table 5. The first line of each dimension represents the absolute Alpha and Std Alpha of the dimension.

**Table 5: Results of alfa Cronbach for each dimension of the knowledge management processes**

Question	Alpha	Std Alpha	(item, total)
<b>Dimension: Creating knowledge</b>			
G1	0.8583	0.8607	
G1-A	0.8091	0.8108	0.7336
G1-B	0.8148	0.8178	0.7152
G1-C	0.8105	0.8148	0.7242
G1-D	0.8446	0.8457	0.6496
<b>Dimension: Capturing knowledge</b>			
G2	0.7999	0.8105	
G2-A	0.8171	0.8208	0.4989
G2-B	0.7293	0.7474	0.6531
G2-C	0.7041	0.7190	0.7059
G2-D	0.7473	0.7545	0.6398
<b>Dimension: Organizing knowledge</b>			
G3	0.8547	0.8596	
G3-A	0.8331	0.8397	0.6661
G3-B	0.7814	0.7948	0.7728
G3-C	0.8045	0.8111	0.7215
G3-D	0.8362	0.8373	0.6630
<b>Dimension: Storing knowledge</b>			
G4	0.8339	0.8449	
G4-A	0.7886	0.7976	0.6846
G4-B	0.7615	0.7768	0.7288
G4-C	0.7682	0.7867	0.7139
G4-D	0.8454	0.8480	0.5767
<b>Dimension: Disseminating knowledge</b>			
G5	0.814	0.8308	
G5-A	0.7351	0.7411	0.6438

G5-B	0.7872	0.8031	0.5466
G5-C	0.7255	0.7553	0.6276
G5-D	0.7557	0.7703	0.5874

**Dimension: Applying knowledge**

G6	0.784	0.8219	
G6-A	0.7012	0.7295	0.7133
G6-B	0.8675	0.8685	0.4301
G6-C	0.7128	0.7618	0.6354
G6-D	0.7097	0.7237	0.7246

As in previous cases a value greater than 0.7 was computed for Alpha and Std Alpha, this result is enough to ensure the internal consistence of the instrument for each dimension of knowledge management processes.

The next step was to compare the table with the pre-test and post-test results in order to measure if the perception of the participants in the MOOC is better or worse than in previous MOOC. To complete this task first and verify the normality of the data set, a Shapiro-Wilk test was done, confirming that data do not represent a normal distribution of probability. Then, a non-parametric unilateral Wilcoxon test was chosen to test the equality of the means of both questionnaires. The H0 hypothesis was that the perception of every dimension of knowledge management was not improved after the MOOC. The results of this test are presented in Table 6.

**Table 6: Wilcoxon test for dimension in knowledge management**

Dimension	p-value
Creating knowledge	0.4862
Capturing knowledge	0.0004524
Organizing knowledge	0.3703
Storing knowledge	0.06734
Disseminating knowledge	5.818e-05
Applying knowledge	1.422e-05

These results allow to reject the H0 hypothesis in the dimensions: *Capturing knowledge*, *Disseminating knowledge* and *Applying knowledge*; and to claim that an improvement in the perception of participants was found for these dimensions of knowledge management processes.

**5 CONCLUSIONS**

Due to the revision of the expert panel the first conclusion is that the instrument proposed measures what it is intended to measure. Thanks to the high level of internal consistence of the instrument, with general Alpha and Std Alpha values upper than 0.9, the second conclusion is that this instrument is a valid one to assess the perception of the processes of knowledge management in MOOC courses.

The first analysis of the pilot MOOC conducted in MiriadaX, shows that some dimensions of knowledge management can improve with the use of social networks:

*Capturing knowledge*, the social network was moderated by teachers or community managers that have the role of identifying the new knowledge and pointing it to the participants, this new knowledge is dynamic and it does not exist in the original lectures of the MOOC course.

*Disseminating knowledge*, the social network is capable to spread knowledge between its participants and other people that originally do not participate in the MOOC. This is due to the fact that the social network used is open and public.

*Applying knowledge*, this improvement cannot be attributed only to the social network or the faculty. This means that the participants feel capable to apply the knowledge acquired to a new situation and this process happens when the participant internalizes the formal and informal learning transforming it into their own knowledge. (Lectures are related to the tacit and implicit learning and social networks are associated to informal learning.)

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