A MOOC for Farmers: Agroclimatic Tools for Crop Protection*

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Abstract

Massive open online courses (MOOCs) are a key strategy for digital education. The MOOCs contribute significantly to people's knowledge about a wide range of topics. Nowadays, several web platforms as Coursera and edX offer MOOCs in different domains, however the platforms mentioned do not offer MOOCs focused on crop management through monitoring of climate elements and factors. In this paper, we present an overview of the MOOC titled: "agroclimatic tools for crop protection" for agricultural-sector Spanish speakers. We show a first MOOC evaluation based on a survey applied to 13 people of rural areas located in Cauca (Colombia) for one video of the "Temperature" MOOC unit. The results indicated that 100 % of the respondents understood clearly the video content and 53, 84 % of the surveyed learners understood all the words used in the video.

Keywords: agroclimatic, learners, monitoring, MOOCs.

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Un MOOC para agricultores: herramientas agroclimáticas para protección de cultivos

Resumen

Los MOOC (massive online open courses, en español "curso en línea masivo y abierto") son una estrategia clave para la educación digital. Estos cursos contribuyen significativamente a los conocimientos que las personas pueden obtener sobre una gran cantidad de temas. Actualmente, distintas plataformas como Coursera y edX ofrecen MOOC en diferentes áreas, sin embargo, ninguna de las mencionadas ofrece cursos en manejo de cultivos a través del monitoreo de elementos y factores climáticos. En este artículo se presenta una visión general del curso "Herramientas agroclimáticas para la protección de cultivos", dirigido al sector agrícola de habla hispana. Mostramos una primera evaluación del MOOC basada en una encuesta aplicada a 13 personas habitantes de áreas rurales del Cauca (Colombia) sobre un video de la unidad "Temperatura" del MOOC. Los resultados indicaron que el 100 % de los participantes entendieron claramente el contenido del video y el 54, 84 % de los encuestados entendieron la totalidad de las palabras usadas en el video.

Palabras clave: agroclimático, aprendices, monitoreo, MOOC.

INTRODUCTION

Massive open online courses (MOOCs) are a new trend in education. These kinds of courses facilitate open access completely; also, the MOOCs are free for the learners [1]. The main differences regarding traditional online courses are the unlimited participation of learners and the fact they are 'signed up to' on a voluntary basis rather than being part of a defined cohort or an independent learner [2].

In addition, MOOCs are focused on the learning process based on the principles of 'just in time learning'. Thus, the learners access materials on demand when they need to know something or they need to develop a particular skill set [1], [3].

Since the emergence of the massive open online courses, several web platforms offer MOOCs in different domains. In the particular case of the climate monitoring for crop management (agroclimatic), Coursera [4] offers 5 related MOOCs and edX [5] presents 3 MOOCs. Table 1 shows a summary of the MOOCs offered by the mentioned web platforms.

Table 1. Summary of the MOOCs

Platform	MOOC	Institution	Language
Coursera	Sustainable agricultural land management	University of Florida	English
Coursera	Agriculture, economics and nature	University of Western Australia	English
Coursera	Agricultura urbana y periurbana	National Autonomous University of Mexico	Spanish
Coursera	Climate adaptation in Africa	University of Cape Town	English
Coursera	Climate change and water in mountains: a global concern	University of Geneva	English
edX	AGRIMONITOR: Agricultural policy, food security and climate change	Inter-American Bank for Development	English/ Spanish
edX	Introduction to Environmental Science	Dartmouth College	English
edX	Climate Change Education	Inter-American Bank for Development	English

Source Coursera [4] and edX [5]

Although, the mentioned massive open online courses present topics related with agriculture and climate, these MOOCs lack of the issues presented below:

- The knowledge of the learners in agricultural or climate must be advanced.
- 75 % of the MOOCs are offered in English language.
- The MOOCs are not focused on the crop management through monitoring of climate elements and factors.

To tackle the aforementioned issues, we proposed a MOOC named "agroclimatic tools for crop protection" focused on agricultural-sector native Spanish speakers. The rest of the paper is organized as follows: Section 1 explains the canvas of the proposed MOOC; Section 2 presents the results and Section 3 provides the conclusions and future work.

1. MOOC CANVAS

In this section, we explain the design of the proposed MOOC: "agroclimatic tools for crop protection". To construct this MOOC, we adapted the methodology in [6] according to the following steps:

1.1 Human

The people involved in the development of the MOOC as teachers and audiovisual communication team are members of Project MOOC MenTES-"Construcción de capacidades para la gestión de MOOC para la formación profesional, el desarrollo rural y nuevas generaciones de estudiantes rurales en el Mejoramiento de su Tránsito a la Educación Superior" (Develop of capacities for the management of MOOCs for professional training, rural development and new generations of rural students in the improvement to higher education). The members are described in detail bellow.

1.1.1 Human resources

The MOOC is conducted by three teachers with experience in machine learning algorithms, environmental sciences and agroclimatic monitoring. Table 2 presents the teachers profiles.

Table 2. Teachers profile of the MOOC: agroclimatic tools for crop protection.

Teacher	Profession	Experience
David Camilo Corrales	Ph. D. in Telematics Engineering and Ph. D. in Computer Science	Design of machine learning algorithms for detection of diseases and pest in crops.
Apolinar Figueroa	Ph. D. in Biological Science	Evaluation of environmental impact for tropical ecosystems.
Juan Carlos Corrales	Ph. D. in Computer Science	Agroclimatic monitoring from Service Oriented Architectures.

Source: own elaboration.

1.1.2 Technical support

Concerning technical support, the MOOC was produced by a team of experts in audiovisual and multimedia communication. They addressed the recording, production, mixing and mastering process of the MOOC videos.

1.2 Intellectual resources

We used intellectual resources as technical reports, research papers and books to support the concepts presented in the MOOC.

1.3 Equipment

1.3.1 Hardware resources

The team of audiovisual and multimedia communication used the following hardware resources for recording the MOOC videos: Sony FS7 camera (1 item), Sony UWP-D11 (1 item), Teleprompter (1 item), Manfrotto 504HD Tripod (1 item), and Lyra Bi-Color 3200K-5600K Soft Panel 1 x 1 Studio & Field LED Light (5 items).

1.3.2 Software resources

Once the videos were recorded, the audiovisual and multimedia communication team produced the MOOC videos through these software tools: Adobe Premiere Pro CC (1 license), Adobe After Effects CC (1 license) and Adobe Audition CC (1 license).

1.4 Platform

The MOOC is offered in the platform Selene Unicauca [7]. This platform was developed on Open edX. Regarding the MOOC audiovisual content, the videos are uploaded in YouTube servers [8]. Subsequently, the URLs of the videos are linked from the Selene platform. The content supported by Selene Unicauca is explained bellow.

1.4.1 Assessment activities

Several evaluation technologies are supported by Selene Unicauca. To build the MOOC, we considered the following assessment technologies [9]:

- **Checkbox:** the user chooses one or more correct options from a list of possible answers
- **Multiple Choice:** the user selects one answer from a set of possible answers
- **Numerical Input:** the user employs numbers or mathematical expressions to answer a question
- **Text Input:** the user inputs text into a response field as words, letters, and special characters

1.4.2 Social tools

We harnessed the forum offered by Selene. This social tool allows the communication and interaction among learners of the MOOC.

1.5 General description

This section presents the general description of the MOOC as the title, the lenght and the keywords.

1.5.1 Title

Agroclimatic tools for crop protection.

1.5.2 Lenght

The MOOC duration is 4 weeks. The time dedicated weekly to the MOOC will be 3 hours.

1.5.3 Area

Agriculture, weather monitoring in crops, climate.

1.6 Target learners

The MOOC is addressed to agricultural-sector people from Colombia. As minimum requirements, the learners must attend the high school or demonstrate a high school degree. Also, the learners must present skills in office software tools as Word, Calculator and a web browsers.

1.6.1 Motivation

This MOOC will help its learners to manage crops through the monitoring of climate elements and factors. Besides, the learner will be able to understand agroclimatic information available in Colombian Web applications.

1.7 Pedagogical approaches

The research employed case-based learning as a pedagogical approach. The teachers presented definitions of agroclimatic monitoring related with real cases. For example, definitions of climate elements as temperature, humidity, precipitation, solar radiation and wind are explained from real cases presented in crops.

1.8 Objectives and competences

1.8.1 Objectives

The general objective of the MOOC learners is to acquire knowledge in agroclimatic monitoring, and as specific objectives:

- Understand the climate effects on crops.
- Learn about agroclimatic monitoring technologies.

1.8.2 Competences

The MOOC learners will obtain the next competences:

- Analytical skills of the climate effects caused on crops.
- Skills in agroclimatic monitoring technologies.

1.9 Learning content

This MOOC is composed by four work sections and each one will be presented for one week. Table 3 shows the learning content for this MOOC as sections, subsections, unit and format learning content.

Table 3. Learning content of the MOOC: agroclimatic tools for crop protection.

Week	Section	Subsection	Unit	Format
1	Orientation	Orientation	How does Selene work?	Video tutorial
			Course presentation	Video recorded in outdoor
2	Climate	Elements	Temperature	Videos recorded in television studio
			Humidity	
			Precipitation	
			Solar radiation	
			Wind	
		Factors	Latitude and altitude	
			Topography	
			Continental	
3	Agroclimatic monitoring	Agroclimatic concepts	Agroclimatic	
			Macro-climate	
			Meso-climate	
			Microclimate	
		Manual monitoring	Homemade thermometer	Videos recorded in outdoor locations
			Homemade hygrometer	
			Homemade pluviometer	
			Homemade anemometer and wind vane	
		Automated monitoring	Weather station	
4	Technologies for agroclimatic monitoring	Understanding the Agroclimatic charts	Cartesian plane	Video recorded on slides
			Line chart	
			Column chart	
		Agroclimatic monitoring from computer	AgroCloud	Video tutorials
			AgroClima	
			Agronet	

Source: own elaboration.

MOOC learning content was presented through videos recorded in outdoor locations (section: agroclimatic monitoring), a television studio (sections: orientation and climate) and video tutorials (section: technologies for agroclimatic monitoring).

Figure 1 (a) shows the video recorded in outdoor locations of the "Homemade hygrometer" unit by Ph.D. Apolinar Figueroa and David Camilo Corrales, and figure 1 (b) shows the video recording of the "Homemade pluviometer" unit by Ph.D. Juan Carlos Corrales.

Videos recorded: homemade hygrometer Video recorded: homemade pluviometer

Figure 1. Videos recorded in outdoor locations.

Source: own elaboration.

In addition, figure 2 (a) depicts the video recorded in the television studio of the "Temperature" unit, and figure 2 (b) shows the video recording of the "Agro Climate" unit. These videos were recorded by Ph. D. David Camilo Corrales.

Videos recorded: Temperature Videos recorded: AgroClimate

Figure 2. Videos recorded in television studio.

Source: own elaboration.

The post-production video of the "Temperature" unit is available in the Youtube channel of the Mooc MenTES project in the following URL: https://youtu.be/G45LxOwIID0.

1.10 Assessment activities

We designed formative and summative activities to assess each MOOC section. As formative activity, we propose a learner's presentation through a video selfie in the MOOC section "Orientation". The remaining MOOC sections summative activities were designed based on multiple choice and checkbox test forms. Additionally, in the "Agroclimatic monitoring" MOOC section, we propose as a summary activity the peer assessment of videos recorded by the learners building homemade instruments for climate monitoring. Table 4 presents a summary of the MOOC assessment activities.

Table 4. Assessment activities of the MOOC: agroclimatic tools for crop protection.

Week	Section	Assessment	Activity
1	Orientation	Formative	Learner's presentation through a video selfie
2	Climate	Summative	Multiple choice form Checkbox form
3	Agroclimatic monitoring	Summative	Multiple choice form Checkbox form Peer assessment: video recording of the crafting of a homemade instrument for climate monitoring.
4	Technologies for agroclimatic monitoring	Summative	Text input forms

Source: own elaboration

1.11 Complementary technologies

1.11.1 Learning content

For the MOOC section: "Technologies for agroclimatic monitoring" of the Learning Content, we used the next complementary agroclimatic platforms:

- AgroCloud [10] - http://www.agrocloudcolombia.com/
- AgroClima [11] - http://agroclima.cenicafe.org/
- Agronet [12] - http://www.agronet.gov.co/agroclima/Paginas/default.aspx

1.11.2 Complementary technologies for communication among learners

With the purpose of encouraging communication and discussion among learners, we propose the use of social networks such as Facebook.

2. RESULTS

We proposed a survey to assess the MOOC learning videos. This survey contains 4 questions:

a) Do you understand the video? (scale: 1 lowest qualification and 5 highest qualification)

b) Do you understand the words used in the video? (scale: 1 lowest qualification and 5 highest qualification)

c) Is the video interesting? (scale: 1 lowest qualification and 4 highest qualification)

d) Would you like to watch other related videos? (scale: Yes, No, Perhaps)

In this section, we present the results of the survey for the video of the MOOC "Temperature" unit.

Thirteen people of rural areas located in Cauca (Colombia) filled the survey. Figure 3 presents the location (in percentages) of the respondents. 23.08 % of the surveyed people live to close to Popayán, while 30.77 % of the respondents live in Suárez and 15.38 % of the respondents are located in villages near to Sotará town. The remaining of the respondents live in towns as Timbio, Cajibío, Caldono and Santander de Quilichao (7.69 % each one).

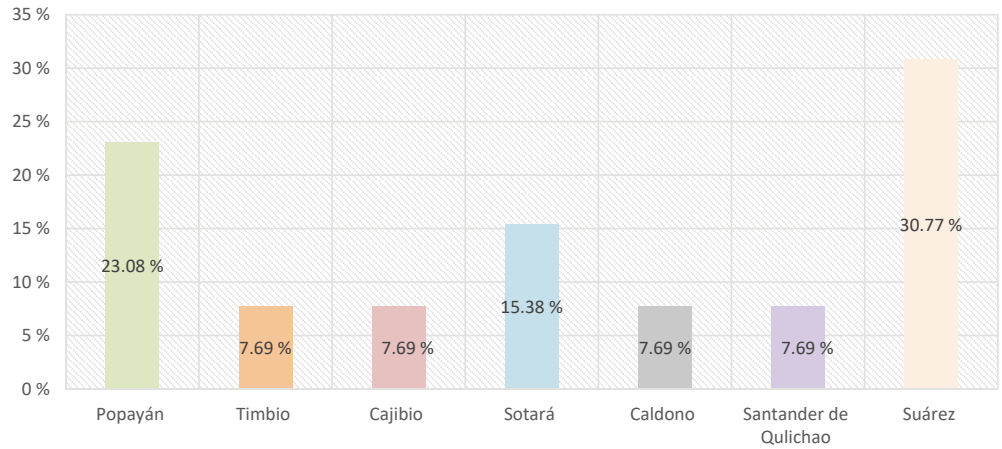

Figure 3. Location of the respondents.

Source: own elaboration

On the other hand, the respondents are between 15 - 29 years old, and the average age is 22 years. Figure 4 shows the respondents age percentage distributed in three ranges. 23.08 % of the respondents are under 18 years, 61.54 % of the respondents are between 18 and 25 years, while 15.38 % are over 25 years.

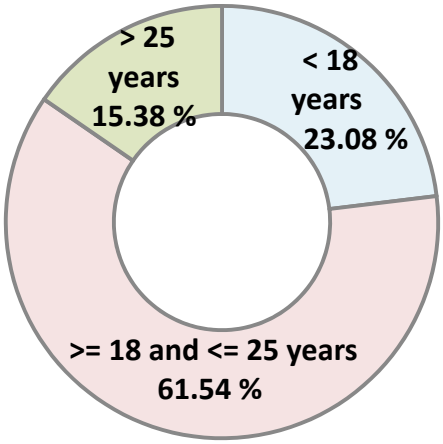

Figure 4. Respondent's age.

Source: own elaboration

The results obtained for question (a) indicate that 100 % of the respondents answered "5". In other words, the surveyed people understood clearly the video content. However, for the question (b), 53.84 % of the respondents understood all the words used in the video, and 46.15 % of the respondents recognized the vast majority of words presented in the video. Concerning the question (c), 92.31 % of the surveyed people considered that the video was very interesting and 7.69 % of the respondents answered that the video content was normal. Finally, in the results of the question (d), 100 % of the respondents would like to watch other related videos.

3. RESULTS ANALYSIS

The good results obtained by the video of the MOOC "Temperature" unit occur due to the use of resources and didactic materials. These kind of tools have been quite successful at teaching other courses in general since they lead to meaningful teaching and learning [13]. In the sections "Orientation", "Climate" and "Agroclimatic monitoring", the production used instruments of presentation and transmission similar to elements used in the "Temperature" video. These included, amongst others: images, maps, photographs, sketches and diagrams. Dynamic and attractive visual material is frequently used to present between 40 % and 50 % of the courses content (via textbooks, video, etc.), it allows to be closer to students and the media they are accustomed to, such as television, computer games and mobile applications [14]. The challenge of the presented MOOC corresponds to evaluate the "Technologies for agroclimatic monitoring" section. It includes more theoretical and intangible elements, such as mathematical functions represented in a cartesian coordinate system once the students understand the concepts of previous MOOC sections.

The respondents insight of the "Temperature" video is available in the Youtube channel of the Mooc MenTES project at the URL: https://www.youtube.com/watch?v=ucOdMyF2yHk.

4. CONCLUSIONS AND FUTURE WORK

In this paper, we proposed a MOOC titled "agroclimatic tools for crop protection" focused in agricultural-sector people with Spanish as their mother tongue. We show a first MOOC evaluation based on a survey applied to 13 people of rural areas located in Cauca (Colombia) for the video of the MOOC "Temperature" unit. Although the survey results present good qualifications, the respondents sample is very small and the evaluation of one MOOC video is not enough. In this sense, we propose as future works:

- The design of an experimental formal evaluation based on popular approximations proposed by MOOC Research Initiative and the European MOOCs Stakeholder Summit [15] as an eLearning Course, by the process perspective or via the outcomes perspective.
- The development of MOOC specialization programs to deepen the expertise in agroclimatic monitoring through a series of related courses as training in meteorological stations, climate data analysis and early warning systems for diseases and pest detection based on climate variables.
- Once each MOOC section is successfully completed, the research proposes offering a verified certification for each course in the agroclimatic monitoring specialization.
- Similar to Coursera Specializations, the research proposes the offering of a capstone project once completed and passed all Specialization MOOCs. This project allows the learners to demonstrate the knowledge acquired in the Specialization MOOCs.

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