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On-line Specialized Courses on Geothermal

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ABSTRACT

The use of the information and communication technology in education is playing a major role even in specialized capacity building. The Mexican Center of Innovation on Geothermal (CeMIE-Geo) has dedicated enormous effort in its capacity building programs. The most successful activity is the on-line basic course Introduction to Geothermal that was launched in the Coursera platform the 17th August 2017 and that year finished as the 6th most successful course in the world in Spanish. Presently, it has attracted more than 43,000 visits, more than 9,000 registered students, almost 6,500 regular students and more than 600 graduate students. The course has had a strong impact in Latin-American countries, as it is the only specialized geothermal course in Spanish, and students have frequently contacted our university to pursue further education on geothermal.

The CeMIE-Geo is now preparing other specialized courses on: Direct use of geothermal resources, Geothermal Geochemistry, Geothermal Geology and GIS applied to geothermal exploration, which will conform a specialized group of courses that will provide interested students with the basis on Geothermal Exploration.

1. INTRODUCTION

In the XXI century, the electricity production in the whole world is going through a drastic transformation driven by socio-economic, technological, political and mostly environmental reasons. The energy sources are diversifying introducing in larger proportion the clean renewable energy sources. Geothermal is a base load energy source with a versatility that allows direct uses that include industrial, agricultural, urban and leisure, in addition to the electricity production.

The world reports on clean electricity production indicate that geothermal energy is being sub-utilized, and the increase of geothermal energy production requires numerous well-trained professionals to develop new projects and innovative technologies that promote a wide use of this energy source.

The need to create training courses that reach wide audiences is evident, and the presently available formal courses in the world can train a reduced number of students. The list of courses on geothermal is available in the IGA site and covers most continents, yet there are economic restrictions for many students to pursue specialized education on geothermal. The Mexican government announced in 2014 that there was the need to train at least 130,000 high level professionals on energy topics, and it is not feasible to do it with traditional courses. Specifically, on geothermal there are no graduate diploma courses in Mexico and the graduate programs only include few courses related to geothermal exploration. This challenge suggested to the group of lecturers that the only option was to create on-line courses in collaboration with the Coordination of Open University of the Mexican National Autonomous University (Universidad Nacional Autónoma de México-UNAM). The didactic materials used in the graduate courses on geothermal exploration were the basis to create the on-line version of the Introduction to Geothermal course.

The MOOC “Introducción a la Geotermia” (Introduction to Geothermal) was produced by the Mexican Center for Innovation on Geothermal Energy (Centro Mexicano de Innovación en Energía Geotérmica-CeMIE-Geo), in collaboration with UNAM, and it is hosted in the platform Coursera.org since August 14th, 2017 and was updated in July 2018. In the first year after being launched, it reached to the 6th place in the ranking of the most requested courses in Spanish.

2. MASSIVE OPEN ON-LINE COURSES

Presently, formal, as well as self-taught education, have a huge support from the internet resources: lectures, videos, tutorials, discussion forums, etc. These resources lead to a massification of the education. This is a great help to the formal education in the universities that have restrictions in admissions and groups of hundreds of students are not advised by didactic methods. On the other hand, there is the need to educate the population in topics of global impact and train hundreds of experts in specific subjects.

The Massive Open On-line Courses (MOOC’s) were produced by the technological evolution in education and correspond to the creation of a new learning environment, where connectivity and unrestricted access to information (time wise), in addition to global interactions, transform the construction of knowledge in an interesting phenomenon by modifying, not only the teacher-student experience, but also all the didactic methodology.

The term MOOC was originated in Canada, Dave Cormier and Bryan Alexander crated the acronym to describe an on-line course designed by George Siemens and Stephen Downes at the Manitoba University: “Connectivism and Connective Knowledge”. This course was attended by 25 paid students in the campus and 2,300 students that took the course on-line for free (Daniel, 2012).

Still, the MOOC methodology goes beyond the availability of lectures in the form of video-lectures because one of the main characteristics is the enormous diversity of didactic resources and learning objects that may utilized, for instance lectures, discussion forums, assignments, simulators, etc. Therefore, the start of the MOOC’s promoted the development of virtual environments capable to support all the possible didactic resources and the numerous students that will be using them.

Coursera started in 2012 as the first platform to possess all the requirements. It was founded by Prof. Daphne Koller and Andrew Ng from Stanford University, they observed that by putting the courses on-line, the transfer of knowledge could reach several thousands of students in a few months. These results could not be attained in a whole life dedicated to teaching.

The MOOC’s impressive success increased the offer and the demand, and the number of platforms increased sharply. The most popular in the world are: Coursera, Edx, Udacity, Udemy, Openclass and UniMOOC, most of them are sponsored by universities.

This revolution in education has prompted many universities, lecturers and professors to join the on-line education wave, creating diverse courses that cover most disciplines and topics. However, as the courses are open, they require a specialized design in the course structure and the presentation of the contents, depending on the target audience.

3. CONTENTS OF THE COURSE “INTRODUCTION TO GEOTHERMAL”

The course aims to familiarize the students with the geothermal exploration techniques. The previous knowledge required from the students is the basic Engineering/Geosciences/Environment/Physics-Mathematical knowledge.

The course includes topics on Geology, Geochemistry, Geophysics and some economic themes to introduce the concept of evaluation of the energy resource. Also, the course aims to explain the wide range of applications that geothermal energy has, in addition to the electricity production. The assignments are intended to promote the interest of the students in the local resources and the possibilities of direct applications. Mostly, to encourage the students to look for more information and recognize the surface manifestations of geothermal activity in their own country.

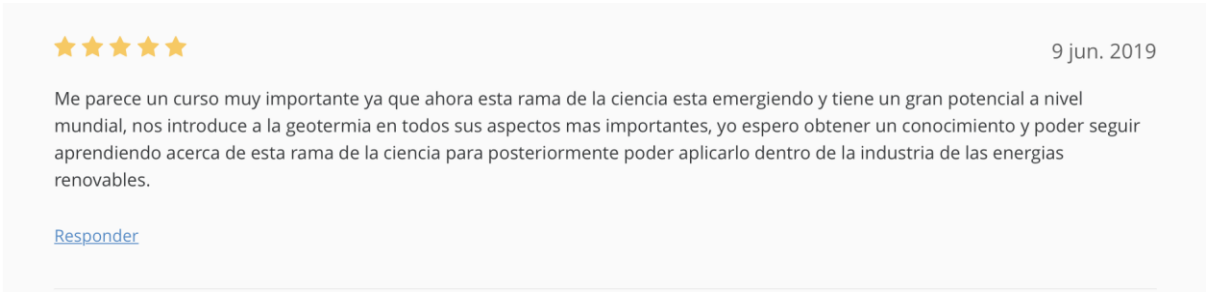
4. STATISTICS- MEASURING THE SUCCESS OF THE ON-LINE COURSE ON GEOTHERMAL

The platform Coursera provides measures to evaluate how successful a course is; weekly statistics of total learners, active learners and course completers and the comparison with previous week. Also, a yearly evaluation mentions the 10th most popular courses overall. These data allow to evaluate how attractive the didactic materials are for the average students; additionally, public interest on the subject of the course affects directly the increase of learners. In the case of the “Introduction to Geothermal” course, being the first on-line course on geothermal and in Spanish, it attracted hundreds of interested students. This success was directly related to the subject: clean energy. Presently, the total learners are more than 9000, more than 600 completers and almost 6500 active learners. These numbers, in two years, reflect the need to reach larger audiences than the regular training courses at universities and institutes. In spite of being a course on Spanish, the registered students come from 75 different countries (Table 1)

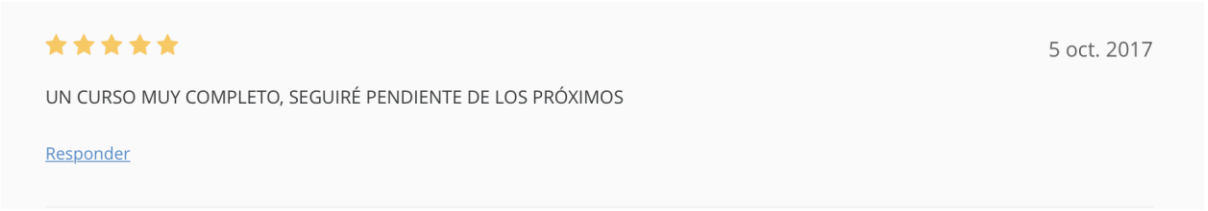
Table 1: Country of provenance of the students registered in the course (Consulted July 29th, 2019).

No.	Country Name	Course Learners Count	No.	Country Name	Course Learners Count	No.	Country Name	Course Learners Count
1	Mexico	4900	26	Russian Federation	10	51	Iceland	2
2	Colombia	885	27	China	8	52	Algeria	2
3	Chile	791	28	Switzerland	7	53	Israel	1
4	Peru	468	29	Portugal	7	54	Saudi Arabia	1
5	United States	343	30	Australia	6	55	Denmark	1
6	Spain	311	31	Norway	5	56	Sweden	1
7	Argentina	238	32	Puerto Rico	5	57	Hungary	1
8	Ecuador	211	33	Netherlands	4	58	Jordan	1
9	Venezuela	112	34	Ukraine	4	59	Indonesia	1
10	El Salvador	91	35	New Zealand	4	60	Congo	1
11	Bolivia	88	36	Egypt	4	61	Romania	1
12	Guatemala	77	37	Taiwan	4	62	Aruba	1
13	Honduras	66	38	Morocco	4	63	Kazakhstan	1
14	Costa Rica	50	39	India	3	64	Estonia	1
15	Brazil	43	40	Korea, Republic of	3	65	Albania	1
16	Nicaragua	42	41	Ireland	3	66	Azerbaijan	1
17	Germany	23	42	Turkey	3	67	Suriname	1
18	Dominican Republic	21	43	Belarus	3	68	Thailand	1
19	Canada	19	44	Austria	2	69	Rwanda	1
20	France	17	45	Belgium	2	70	Singapore	1
21	Uruguay	15	46	Japan	2	71	Slovakia	1
22	Italy	14	47	Nigeria	2	72	Bonaire, Saint Eustatius and Saba	1
23	Paraguay	13	48	Bulgaria	2	73	Serbia	1
24	United Kingdom	13	49	Greece	2	74	Cuba	1
25	Panama	11	50	Uganda	2			

It is important to emphasize that the MOOC Introduction to Geothermal is unique, there is no other course in any of the platforms and in any language that is solely devoted to geothermal. This explains the reason why 1,288 students pre-registered before it was launched and many students, whose mother tongue is not Spanish, are registered and many of them are completers of this course. It is a fact that regardless of the importance of renewable energy, the on-line course offer is rather slim. As a result, the students of this course frequently request that more specialized courses should be produced on this topic, some comments of the students are shown in Figures 1 and 2. The success of the course can be evaluated by the students ranking: 4.9 – 5, one of the highest in Coursera.



(A)



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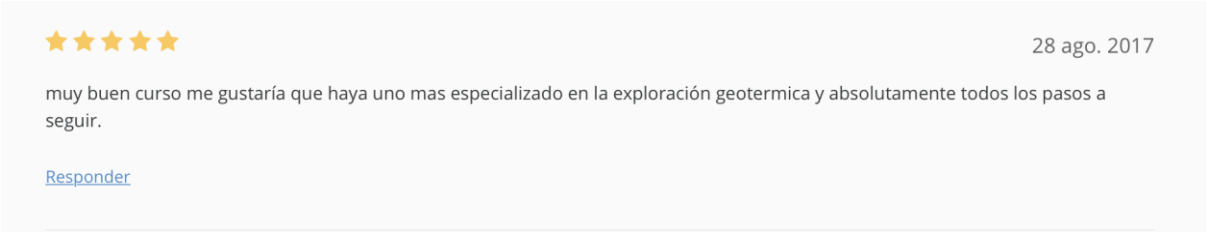
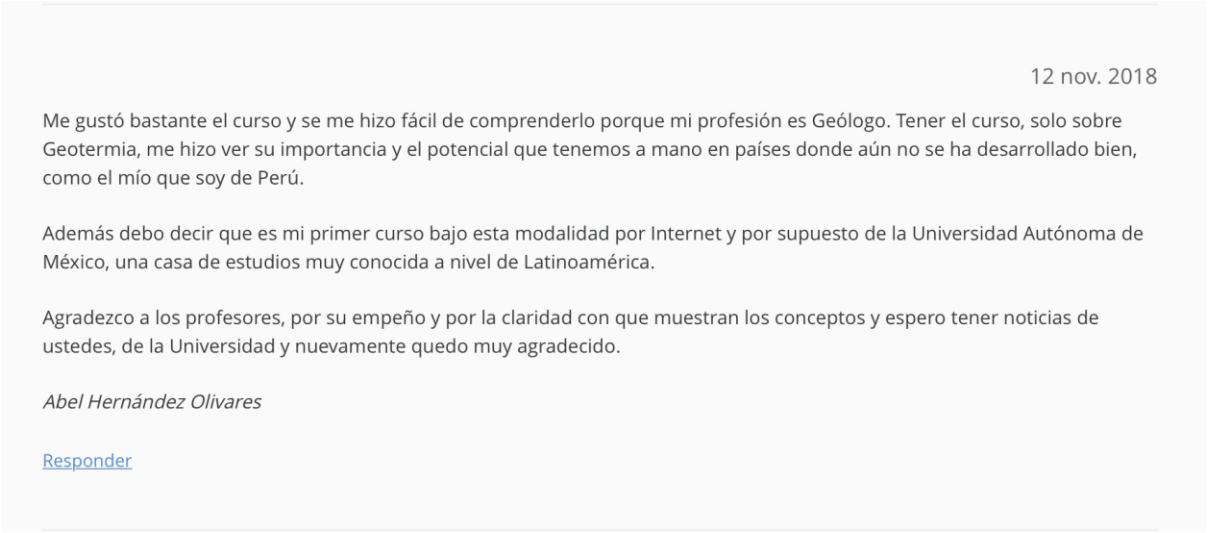
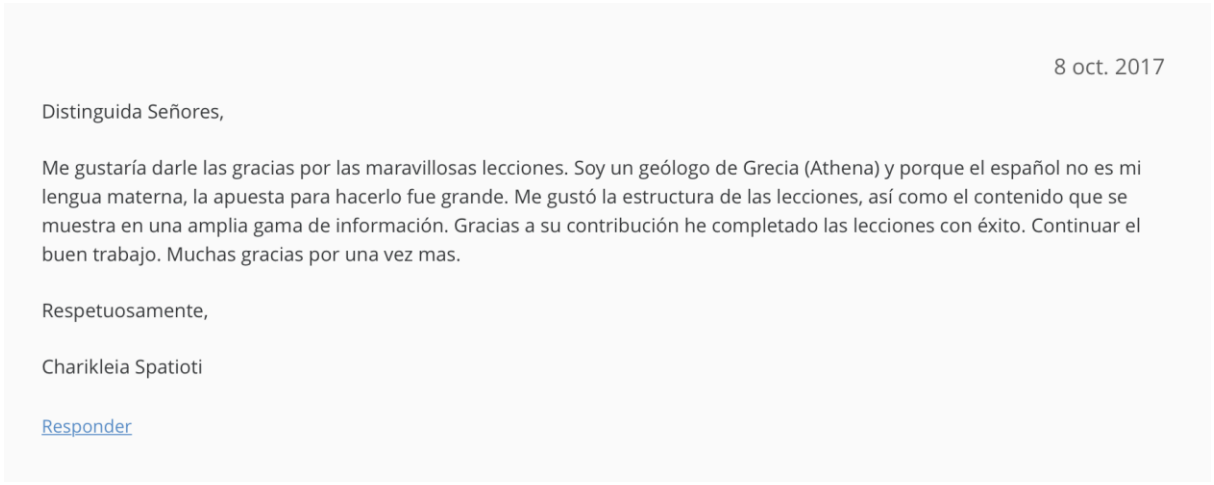


(C)

Figure 1: A, B, C Evaluation of the students for the MOOC "Introducción a la Geotermia" and requests for further more specialized courses.



(A)



(B)

Figure 2: A, B Evaluation and comments by students of the course "Introducción a la Geotermia".

5. THE FUTURE OF MOOC'S ON GEOTHERMAL

The CeMIE-Geo is planning future more specialized courses based on the results of the introductory course. The new courses include Geothermal Geology, Geothermal Geochemistry, Direct uses and GIS applied to Geothermal Exploration. These courses will be integrated in a specialized program on geothermal that will require graduate education on related subjects.

The MOOC's are an exceptional learning experience, but future technological and didactic tools will enhance this type of education (Aguaded-Gómez, 2013). They are a powerful tool in Geosciences education, but the design and the contents require a team of professional to guide the lecturers during the elaboration of the didactic material.

The MOOC "Introduction to Geothermal" was designed for dissemination of geothermal energy with general topics that would not represent a challenge to college students but that could provide more specialized information to graduate students. Special efforts were dedicated to make the materials attractive and not only informative. The future specialized courses will include more elaborate material, but the visual appeal should be maintained.

The design of on-line courses requires the knowledge of the lecturers and the expertise of professionals in graphic design and visual communication, and more importantly, to take into account the characteristics of the target audience (age, education, nationality, socio-economic level, etc.); therefore, the elaboration of successful on-line courses requires the work of a multidisciplinary team.

The new communication and information technologies have produced the development and evolution of the MOOC's, but it is important to consider that technological innovation requires evolution of educational methodologies in the learning process and in the lecturer-student relation. The future of these new educational tools is strongly linked to the development of energy sources by on-line trained professionals.

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Table 1 https://www.coursera.org/teach/geotermia/analytics/reach

Consulted 23 July 2019

Figure 2. https://www.coursera.org/teach/geotermia/analytics/ratings

Consulted 23 July 2019

Figure 2 https://www.coursera.org/teach/geotermia/analytics/stories

Consulted 23 July 2019