

A Preliminary Evaluation of the Determinants of Certification Success in MOOCs: A Multi-level Study

Full paper

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Abstract

In this paper, we investigate the determinants of certification success in massive open online courses (MOOCs) using multi-level modeling. Our model includes individual student level characteristics as well as country-level infrastructure, economy and culture-related variables. In our complete model, which contains both developing and developed countries, we observe that two country-level variables; internet bandwidth and Hofstede's uncertainty avoidance cultural dimension are positively associated with the probability of getting certified in MOOC environment. We also observe that age, gender, education level and the institution attended are significantly associated with the probability of getting certified in MOOC environment. Furthermore, our study reveals that the determinants of certification vary between developing and developed countries.

Keywords

MOOC, multi-level modeling

Introduction

Massive Open Online Courses (MOOCs) have been heavily debated especially within the realm of higher education. While its definition and implementation to date may vary across institutions (Liyanagunawardena, Adams and Williams, 2013), these courses are characterized as tuition-free and large-scale courses, which are delivered via the Web to participants around the globe by predominantly accredited institutions (Koller, 2015; Vardi, 2012; Liyanagunawardena et al., 2013). Some considered MOOCs as an alternative to traditional higher education given the heightened concerns with increasing higher education costs especially in U.S. (Harker, 2014), and the continuing problem of delivering higher education at a large scale (Pope, 2015). At the earlier stages, some predicted that this web-based platform would eventually replace the traditional higher education system (Koller, 2015; Pope, 2015; Vardi, 2012). White (2014) disputes this point and notes that MOOCs follow the Gartner Hype Cycle (Linden and Fenn, 2003), where MOOCs are phasing out of the "peak of inflated expectations" stage. He points out that this technology is in the state of "trough of disillusionment," where the initial hype tends to disappear, some suppliers leave the market and surviving ones remain to improve the product to meet customers' needs (Linden and Fenn, 2003). Some anecdotal observations provide supporting evidence for White's conclusion. Some providers like Udacity changed its original mission and began to focus on providing training to the corporate world and other educational institutions continue to tinker the implementation of MOOCs to leverage its benefits within a traditional college setting (Pope, 2015).

The common consensus in the literature is that there has not been a sustainable operating model established for the MOOC initiatives and there are important obstacles and issues experienced within this platform (Davis, Dickens, Leon Urrutia, Vera, del Mar & White, 2014; Liyanagunawardena et al., 2013 and Vardi, 2011). Among these obstacles and issues, the issue of assessment, pedagogic obstacles, and very low

completion or certification rates are prevalent. The certification rates reported in the literature varies from 4% to the maximum of 19.2% (Liyaganawardena et al., 2013; Pope, 2015). Given this low certification rate, we seek to explore the determinants of certification success in MOOC environment in this paper. Based on our review of the literature, we have not found any empirical study, which investigated this phenomenon using multi-level modeling. Although, Haggard (2013) notes that completion of a MOOC is not a relevant metric since some participants register out of curiosity or simply pursue simple interest, we believe MOOC completion is very relevant, especially if MOOC is going to be a serious platform where higher education can be delivered especially in developing countries.

In order to address the primary research question, we use a dataset from Edx (www.edx.org), which contains individual participant information from several Harvard and MIT massive open online courses. As Harker (2014) notes, worldwide demand for university education has been growing and MOOCs are especially important for developing countries. We observe this phenomenon in our dataset as well. Approximately, 41.5% of the students participating in massive open online courses of Edx are from developing countries. Hence, as our secondary research question, we seek to evaluate whether the determinants of success vary between developed and developing countries.

In the following sections, we will discuss our theoretical framework for our study, provide a brief literature review, outline the research model and design and finally discuss our analysis and findings.

Theoretical Framework and Literature Review

In this study, we are treating MOOC as an information and communication technology (ICT) innovation, where institutions are leveraging interconnected technological artifacts to innovate the higher-education process (Xiao, Califf, Sarker and Sarker; 2013). Several studies in the literature emphasize the importance of environmental factors such as economy, regulatory structure and culture on ICT diffusion, use and innovation within developing and developed countries (Tiihonen, Korpela, Mursu, 2006; Touray, Salminen and Mursu, 2013 ; Xiao et al., 2013; Zhu, Kraemer and Dedrick, 2004; Zhu and Kraemer, 2005). Given that we are interested in investigating the determinants of certification success in MOOC platform in both developed and developing countries, we pursue the social embeddedness view in our study (Avgerou, 2008). This implies that ICT innovation is a locally socially constructed course of action and its “course” and use (or not use) depends on what local actors make out of it and how they accommodate it in their lives. Although, MOOC platforms are primarily developed by institutions in developed countries, its eventual use in other countries (especially developing) will be based on the local contextual factors.

Availability of ICT infrastructure inclusive of telecommunication network has been emphasized as an important contextual factor affecting ICT use and diffusion especially within developing countries (Xiao et al., 2013; Touray et al., 2013). Another important contextual factor is economy. Several studies note that economy affects technology diffusion across different countries and information technology use is positively related to country’s income (Andrés, Cuberes, Diouf and Serebrisky, 2010; Guillén and Suárez, 2005). In addition to the aforementioned contextual factors, literature shows that individual characteristics affect the ICT use and adoption as well. In their empirical study, Bagchi and Kirs (2009) find out that gender, age, education and individual income are significantly related to Internet and PC use. Etcheverry, Baccino, Terrier, Marquié and Mojahid (2012) emphasize that age plays a role in information finding activities over the web. The authors note that older people perform better with content-specific search.

Another prominent local contextual factor related to ICT innovation and use is the culture (Ford, Connelly & Meister, 2003; Leidner and Kayworth, 2006; Kappos and Rivard, 2008; Westrup, Al Jaghoub, El Sayaed and Liu, 2003). Many empirical studies show that cultural values moderate or affect ICT use and adoption (Bagchi, Hart and Peterson, 2004; Srite and Karahanna, 2006). One of most prominent conceptualization of culture was developed by Hofstede. He defines culture as “the collective programming of the mind which distinguishes the members of one human group from another” (Hofstede, 2001). While the categories of culture may include nation, organization, religion, ethnic, family, gender, and occupation, Hofstede conceptualizes the culture at the national level and originally measures the culture at the national level using four cultural dimensions: power distance, uncertainty avoidance, masculinity vs femininity, and individualism vs. collectivism (Hofstede, 1983). Although, the

validity of Hofstede’s cultural dimensions has been criticized throughout the years; recent empirical research provides some evidence that the model is still relevant (Minkov and Hofstede, 2011; 2013).

Based on our review, the empirical literature on MOOCs is still limited. This is understandable given the recency of this phenomenon. However, we note of some studies, which are of worthy to discuss in here. Xiong, Tripathi, Nguyen and Najjar (2014) build a theoretical model using the unified theory of acceptance and use of technology (UTAUT) to study the adoption of MOOCs. However, the authors have not tested this model using empirical data.

Davis et al. (2014) conduct a survey in three languages; English, Spanish and Arabic to try to understand the motivations of learners in MOOC environment. The participants are overwhelmingly registered to Coursera and Edx, which are both U.S., based MOOC providers. The learners emphasize that the main reasons for using MOOCs include 1) free tuition, 2) interesting course topics, 3) the need to update personal knowledge, 4) the provider being a world-class university, and 5) convenience (life-work balance). The authors emphasize that different age groups have different reasons to take courses offered via MOOC platforms. For example, the individuals from the age group 18-24 may take courses for career advancement and personal development. Furthermore, it is important to note that the list of reasons vary across different language groups. For example, while 65% of Spanish-speaking respondents mention convenience as a source motivation, only 27.5% of Arabic-speaking respondents cite this factor as such. This provides some evidence that culture matters within MOOC environment as well. The literature review conducted by Liyanagunawardena et al. (2013) also emphasizes this point. Especially, the authors recommend the investigation of cultural differences among MOOC participants and how these affect their overall experience.

Seaton, Bergner, Chuang, Mitros and Pritchard (2014) conduct an empirical study to evaluate the student behavior in MOOC environment. The authors study 108,000 students of an MIT’s engineering course. Majority of the students (76%) spend relatively small amount of time at the course, simply browsing the course components. 7% of the students, who received certification account for the 60% of the total time spent. The authors find that while students interact with the lecture videos and homework assignments majority of the time, they spend less time with discussion forums and online labs. One interesting finding is that half of the certificate owners use less than half of the course resources.

Research Model and Hypotheses

Burton-Jones and Gullivan (2007) emphasize the multi-level nature of system usage in organizations. We leverage this point of view to evaluate the MOOC usage by individuals in a country and conceptualize our research model as a two-level model consisting of individuals and countries. Level 1 represents the individuals taking the MOOCs and the level 2 represents the countries where the individuals are participating from. Since our theoretical framework emphasizes the effect of country-level infrastructure, economy and culture on ICT use, we believe this conceptualization is more appropriate for our study. Our multi-level model is presented in Figure 1 in the following page.

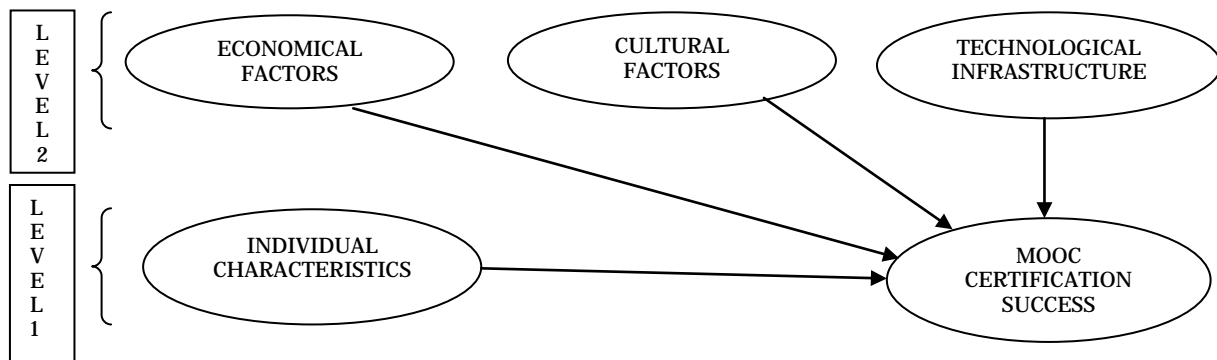


Figure 1. Multi-Level Model

We postulate four sets of hypotheses in our research model. The first set of hypotheses pertains to the effect of country-level technological infrastructure. Xiao et al. (2013) emphasize that advancement in countries' ICT infrastructure including telecommunication network positively affects the level of ICT-driven innovation especially in emerging economies. Furthermore, Touray et al. (2013) cite the lack of ICT infrastructure as one of the critical barriers to ICT use within countries. We postulate that the probability of being successful in MOOC platform will decrease if the student does not have proper access to a PC, latest technologies or internet with proper speed and bandwidth. Furthermore, it has been empirically shown that a country's higher economic affluence is positively associated with technology adoption and use (Zhu and Kraemer, 2005). Given this, we hypothesize the following:

H1: Technological infrastructure (availability of latest technologies, Internet bandwidth and households with personal computer) has positive association with the probability of getting certified in MOOCs platform.

H2: GDP per capita (PPP) is positively associated with the probability of getting certified in MOOCs platform.

Hofstede defines power distance as "the extent of which the less powerful members of organizations and institutions accept and expect that power is distributed unequally" (Hofstede, 2001). Bagchi, et al. (2004) find moderate support for the hypothesis, which postulates that information technology adoption is greater in nations with low power distance. Minkov and Hofstede (2011) clarify the uncertainty avoidance dimension as "the degree of rule orientation that the members of a particular society wish to see in their fellow countrymen and women. Therefore, it predicts the existence of many rules that people want others to follow but does not give us the average degree of personal rule orientation in a society". Previous empirical studies show a positive correlation ($r= 0.34$) between the perception that "more technology is a good thing" and uncertainty avoidance cultural dimension (Hofstede, 2001, p.506). With respect to individualism, Hofstede (2001) defines this cultural dimension as "the degree to which individuals are supposed to look after themselves". He contrasts this concept with collectivism, which is defined as the "degree to which individuals remain integrated into groups". There is empirical evidence showing that IT adoption and use is greater in nations with high individualism. Since MOOCs are primarily used for personal achievement and career advancement (Davis et al., 2014), we expect to observe positive association between the probability of success and individualism. Masculinity-femininity cultural dimension is defined as the "emotional implications having been born as a boy or girl" (Minkov and Hofstede, 2011). Societies may be perceived in a continuum between two opposite poles: tough masculine and tender feminine societies. Bagchi, et al. (2004) finds that there is a strong positive relationship between information technology adoption and culturally feminine nations. Given the arguments provided for each cultural dimension, we postulate the following:

H3.1: MOOC certification success is greater in nations with low power distance when compared to nations with high power distance.

H3.2: MOOC certification success is greater in nations with high uncertainty avoidance when compared to nations with low uncertainty avoidance.

H3.3: MOOC certification success is greater in nations with high individualism when compared to nations with low individualism.

H3.4: MOOC certification success is greater in culturally feminine nations when compared to culturally masculine nations.

With respect to the effect of individual characteristics on ICT use, adoption and innovation, Davis et al. (2014) find that younger and relatively highly educated individuals tend to register to MOOCs. Furthermore, Gefen and Straub (1997) note that males "tend to feel more at ease with computers". This statement is further supported by Bagchi and Kirs (2009), where their empirical study of global PC and Internet use reveal that males tend to use technology more than the females. Given this, we postulate the following hypotheses:

H4.1: MOOC certification success is greater for younger students when compared to older students.

H4.2 MOOC certification success is greater for students with higher level of education when compared to students with lower levels of education.

H4.3: MOOC certification success is higher for males when compared to female students.

Research Methodology and Design

Sample Characteristics

In our study, we use a dataset from Edx, which includes participants of massive open online courses provided by Harvard and MIT. After cleaning up the original dataset, we are able to obtain a sample size of 358,433 participants from 24 countries (Table 1). Students from developing countries accounts for the 41.5% of the total sample.

Country	Number of Students Not Certified	Number of Students Certified	Total Number of Students	% of Total Sample	Percentage of Students Certified	Economic Development Status *
Australia	5152	156	5308	1.5%	2.9%	Developed
France	3452	158	3610	1.0%	4.4%	Developed
United Kingdom	16303	595	16898	4.7%	3.5%	Developed
United States	146280	3216	149496	41.7%	2.2%	Developed
Canada	9724	241	9965	2.8%	2.4%	Developed
Germany	5430	336	5766	1.6%	5.8%	Developed
Greece	3542	225	3767	1.1%	6.0%	Developed
Japan	1400	19	1419	0.4%	1.3%	Developed
Poland	3576	306	3882	1.1%	7.9%	Developed
Portugal	1629	92	1721	0.5%	5.3%	Developed
Spain	7215	638	7853	2.2%	8.1%	Developed
Brazil	14896	367	15263	4.3%	2.4%	Developing
China	3584	47	3631	1.0%	1.3%	Developing
India	74059	2740	76799	21.4%	3.6%	Developing
Indonesia	3112	93	3205	0.9%	2.9%	Developing
Morocco	3427	24	3451	1.0%	0.7%	Developing
Nigeria	6889	139	7028	2.0%	2.0%	Developing
Pakistan	8356	116	8472	2.4%	1.4%	Developing
Bangladesh	2662	29	2691	0.8%	1.1%	Developing
Colombia	2918	120	3038	0.8%	3.9%	Developing
Egypt	7711	99	7810	2.2%	1.3%	Developing
Mexico	4292	110	4402	1.2%	2.5%	Developing
Philippines	4921	78	4999	1.4%	1.6%	Developing
Russian Federation ^	7516	443	7959	2.2%	5.6%	Developing
Grand Total	348046	10387	358433			

* U.N. Country Classification is used

^ Russian Federation is categorized as an economy in transition. Here we categorize it as "developing" for comparison purposes.

Table 1. Sample Characteristics

When we compare the average rate of certification between developing and developed countries, we observe that the rate of certification is higher in developed countries: 4.5 % vs. 2.3%.

	Developed	Developing
Average of % of Students Certified	4.5%	2.3%
Median % of Students Certified	4.4%	2.0%
Software Coefficient of Skewness	0.3	1.1

Table 2. Comparing Developed and Developing Countries’ Rate of Certification

Multi-Level Model and its Measurements

We use two-level hierarchical nonlinear modeling to test our aforementioned hypotheses (Raudenbush and Bryk, 2002). Level 1 variables are related to the characteristics of the individuals, who register to massive open online courses, whereas level 2 variables include the country-level infrastructural, economic and cultural factors. Our dependent variable is generated using the binary variable *CRTFD*, which measures whether an individual has received a certification or not.

LEVEL 1 – VARIABLES (Individual Student Level)		LEVEL 2 – VARIABLES (Country Level)	
CODE	DESCRIPTION	CODE	DESCRIPTION
<i>INST</i> (IV)	Institution where course is taken • 0: Harvard, 1:MIT	<i>LTTECAV</i> (IV)	Availability of latest technologies [1 = not available; 7 = widely available]
<i>CRTFD</i> (DV)	Certificated? • 1: Yes, 0: No	<i>INTBWIDT</i> (IV)	Int’l Internet bandwidth, kb/s per user
<i>EDUCLV</i> (IV)	Student’s Education Level • 1: Less than secondary • 2: Secondary • 3: Bachelor • 4: Master • 5: Doctorate	<i>HHPCPRC</i> (IV)	Households w/ personal computer, %
<i>AGE</i> (IV)	Student’s Age (Continuous Variable)	<i>GDPPC</i> (IV)	GDP per capita (PPP)
<i>GENDER</i> (IV)	Student’s Gender • 0: Male, 1: Female	<i>UNCRTAVD</i> (IV)	Uncertainty Avoidance
		<i>INDVCOLL</i> (IV)	Individualism vs. Collectivism
		<i>MASCFEM</i> (IV)	Masculinity vs. Femininity
		<i>POWDIST</i> (IV)	Power Distance

IV: Independent Variable, DV: Dependent Variable

Table 3. Model Variables and their Measurements

The generic model for our study is defined in Equation (1) and Equation (2). Φ_{ij} represents the probability of success, where the success is defined as the student getting certification from MOOC. η_{ij} , which is the dependent variable in our model, is the log of the odds of success. The estimates of β_{ij} represent the effect of individual level predictors on the log of the odds of success. On the other hand, we designed the Level 2 model to measure the effect of country-level factors on the dependent variable measured at the individual level. The γ coefficients represent the effect of country-level variables directly on the dependent variable.

We centered the Level 2 variables around the grand mean (Raudenbush, Bryk, Congdon, and du Toit, 2011).

Level-1 Model (1)

$$\begin{aligned} \text{Prob}(\text{CRTFD}_{ij}=1|\beta_j) &= \phi_{ij} \\ \log[\phi_{ij}/(1 - \phi_{ij})] &= \eta_{ij} \\ \eta_{ij} &= \beta_{0j} + \beta_{1j}*(\text{INST}_{ij}) + \beta_{2j}*(\text{EDUCLV}_{ij}) + \beta_{3j}*(\text{AGE}_{ij}) + \beta_{4j}*(\text{GENDER}_{ij}) \end{aligned}$$

Level-2 Model (2)

$$\begin{aligned} \beta_{0j} &= \gamma_{00} + \gamma_{01}*(\text{LTTECAV}_j) + \gamma_{02}*(\text{INTBNDWI}_j) + \gamma_{03}*(\text{HHPCPRC}_j) + \gamma_{04}*(\text{POWDIST}_j) \\ &\quad + \gamma_{05}*(\text{UNCRTAVD}_j) + \gamma_{06}*(\text{INDVCOLL}_j) + \gamma_{07}*(\text{MASCFEM}_j) + \gamma_{08}*(\text{GDPPC}_j) + u_{0j} \\ \beta_{1j} &= \gamma_{10} \\ \beta_{2j} &= \gamma_{20} \\ \beta_{3j} &= \gamma_{30} \\ \beta_{4j} &= \gamma_{40} \end{aligned}$$

Analysis and Results

We use HLM 7 (Raudenbush et al., 2011) to execute the aforementioned model firstly on the complete sample, which includes both developing and developed countries. Below we report the results of unit-specific model (Table 4) since we are interested in evaluating how differences in level 2 variables relate to the differences in level 1 dependent variable (Raudenbush and Bryk, 2002). The model’s reliability estimate is 0.951, well within the acceptable limits (Raudenbush and Bryk, 2002).

Fixed Effect	Coefficient	Standard error	t-ratio	Approx. d.f.	p-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	-4.198700	0.102209	-41.079	15	< 0.001
LTTECAV, γ_{01}	-0.303850	0.235674	-1.289	15	0.217
INTBNDWI, γ_{02}	0.009814	0.004302	2.281	15	0.038
HHPCPRC, γ_{03}	-0.016431	0.012924	-1.271	15	0.223
POWDIST, γ_{04}	0.005974	0.009186	0.650	15	0.525
UNCRTAVD, γ_{05}	0.013538	0.006260	2.163	15	0.047
INDVCOLL, γ_{06}	0.005551	0.008797	0.631	15	0.538
MASCFEM, γ_{07}	0.001398	0.009384	0.149	15	0.884
GDPPC, γ_{08}	0.000041	0.000023	1.764	15	0.098
For INST slope, β_1					
INTRCPT2, γ_{10}	0.429595	0.021396	20.078	358405	< 0.001
For EDUCLV slope, β_2					
INTRCPT2, γ_{20}	0.177880	0.013927	12.772	358405	< 0.001
For AGE slope, β_3					
INTRCPT2, γ_{30}	-0.007334	0.001493	-4.911	358405	< 0.001
For GENDER slope, β_4					
INTRCPT2, γ_{40}	0.293015	0.022617	12.956	358405	< 0.001

Table 4. HLM Unit-Specific Results – Complete Sample

We find out that all individual level variables; education level, age and gender are statistically significant at 0.01. We observe that female students are more likely to get certified when compared to their male colleagues. Similarly, younger students are more likely to get certified compared to older students. In line with the literature, students with higher education level are more likely to get certified. We also note that students taking MIT courses tend to get certified more than the students taking courses from Harvard. This may be due to the structure of the MIT courses. All the MIT courses in the sample are not self-paced but structured with deadlines, whereas some Harvard courses are self-paced. This requires further investigation.

With respect to the country level factors, we find out that internet bandwidth, kb/s per user is statistically significant at 0.05. We observe that higher the Internet bandwidth, kb/s per user in a country, more likely that an individual will get certified. With respect to cultural dimensions, we find out that “uncertainty avoidance” is statistically significant at 0.05 and has a positive coefficient. This implies that the students coming from countries, where there is a high rule orientation (Minkov and Hofstede, 2011), are more likely to get certified. We also observe that GDP per capita is statistically significant at 0.1. We infer that higher the GDP per capita in a country, more likely that an individual will get certified.

The results of the unit-specific model, which are explained above, are in line with the results of two other nonlinear hierarchical models: unit-specific model with robust standard errors and population-average model.

We summarize the results of our hypotheses testing in Table 5 below:

Hypotheses	Results for the complete model
H1 (Technical Infrastructure)	Partial support. Internet bandwidth is significant at 0.05
H2 (Economy)	Partial support. GDP per capita is significant at 0.1
H3.1 (Power Distance)	No support
H3.2 (Uncertainty Avoidance)	Supported. Significant at 0.05.
H3.3 (Individualism)	No support
H3.4 (Masculinity)	No support
H4.1 (Individual's Age)	Supported. Significant at 0.01.
H4.2 (Individual's Education)	Supported. Significant at 0.01.
H4.3 (Individual's Gender)	No support. Significant at 0.01. The probability that a female student gets certified in MOOC is higher when compared to male students.

Table 5. Hypotheses Testing Results for the Complete Sample

In order to contrast the determinants of MOOC certification success in developed and developing countries, we ran our generic model using the datasets from developing and developed countries. First, we executed the generic model using the 209,685 participants' data from 11 developed countries. The model's reliability estimate is 0.942. Similar to the results of the complete sample, all individual level variables; education level, age and gender are statistically significant at 0.01. The direction and the intensity of the associations between the individual level variables and the probability of getting certified are very close to the associations defined in the complete model. None of the country-level variables are statistically associated with the probability of getting certified. Please see Table 6 for the complete results.

Fixed Effect	Coefficient	Standard error	t-ratio	Approx. d.f.	p-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	-4.191330	0.123144	-34.036	2	<0.001
LTTECAV, γ_{01}	-0.896885	0.507697	-1.767	2	0.219
INTBNDWI, γ_{02}	0.006860	0.006068	1.131	2	0.376
HHPCPRC, γ_{03}	0.018782	0.022869	0.821	2	0.498
POWDIST, γ_{04}	-0.033396	0.027320	-1.222	2	0.346
UNCRTAVD, γ_{05}	0.029816	0.028653	1.041	2	0.407
INDVCOLL, γ_{06}	0.009710	0.025118	0.387	2	0.736
MASCFEM, γ_{07}	-0.020060	0.011347	-1.768	2	0.219
GDPPC, γ_{08}	0.000007	0.000047	0.152	2	0.893
For INST slope, β_1					
INTRCPT2, γ_{10}	0.595600	0.027647	21.543	209670	<0.001
For EDUCLV slope, β_2					
INTRCPT2, γ_{20}	0.279968	0.017072	16.399	209670	<0.001
For AGE slope, β_3					
INTRCPT2, γ_{30}	-0.008559	0.001632	-5.243	209670	<0.001
For GENDER slope, β_4					
INTRCPT2, γ_{40}	0.308737	0.028560	10.810	209670	<0.001

Table 6. HLM Unit-Specific Results – Developed Countries

Furthermore, we use 148,748 participants’ data from 13 developing countries to evaluate the effect of individual and country level factors on the probability of getting certified from a massive open online course. The reliability estimate for this model is 0.921. At the individual level, only two variables are statistically significant (at 0.01): the institution where course is taken and participant’s gender. The probability of a student getting certified is higher if the course is taken from MIT. Similar to previous models, female students tend to get certified more than the male students. The level of education and age do not have statistically significant association with the probability of getting certified.

Fixed Effect	Coefficient	Standard error	t-ratio	Approx. d.f.	p-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	-3.889350	0.136174	-28.562	4	<0.001
LTTECAV, γ_{01}	-0.470510	0.429848	-1.095	4	0.335
INTBNDWI, γ_{02}	0.038382	0.027299	1.406	4	0.232
HHPCPRC, γ_{03}	-0.059639	0.018467	-3.230	4	0.032
POWDIST, γ_{04}	-0.029399	0.018950	-1.551	4	0.196
UNCRTAVD, γ_{05}	-0.011115	0.009848	-1.129	4	0.322
INDVCOLL, γ_{06}	0.019768	0.016041	1.232	4	0.285
MASCFEM, γ_{07}	0.012322	0.017417	0.707	4	0.518
GDPPC, γ_{08}	0.000181	0.000059	3.076	4	0.037
For INST slope, β_1					
INTRCPT2, γ_{10}	0.154666	0.033302	4.644	148731	<0.001
For EDUCLV slope, β_2					
INTRCPT2, γ_{20}	-0.024409	0.026154	-0.933	148731	0.351
For AGE slope, β_3					
INTRCPT2, γ_{30}	-0.003428	0.003923	-0.874	148731	0.382
For GENDER slope, β_4					
INTRCPT2, γ_{40}	0.270381	0.037252	7.258	148731	<0.001

Table 7. HLM Unit-Specific Results – Developing Countries

With respect to country level variables, we observe that students from countries with higher GDP per capita tend to get certified more when compared to the students from countries with lesser GDP per capita. One contradictory finding is the negative association of the percentage of households with personal computer and the probability of a student getting certified. We postulated that the higher level of household with personal computer in a developing country is associated positively with the probability of getting certified. We find that the association between these two variables is negative: higher level of household with personal computer in a developing country is associated negatively with the probability of getting certified at a significance level of 0.05. Coupling the previous two statistically significant findings, we infer that students from low-income developing countries with relatively low PC ownership are more eager to complete their MOOC certification. MOOC may provide a very rare opportunity for these individuals to gain access to “Ivy League” education content for free. This may be considered as a major motivation for these individuals. We also find that none of the Hofstede’s cultural dimensions are statistically significant.

Conclusion

Our preliminary investigation provides comprehensive empirical evidence with respect to the determinants of getting certified in MOOCs platform. Our study reveals that the determinants of certification vary between developing and developed countries. When we contrast the developed and developing countries, we observe that while country level variables inclusive of Hofstede’s cultural dimensions don’t have any significant effect on students’ probability of getting certified in developed countries, some country level variables such as GDP per capita and percentage of households with PC play a significant role in developing countries. All individual level characteristics in our model play a very important role in the MOOC certification success in developed countries. Especially, we observe that education level and age are significant for getting certified in developed countries. This empirical finding provides further evidence to the conclusion of the previous findings, which note that younger adults with higher levels of education pursue MOOC for professional development and career advancement (Davis et al., 2014). On the other hand, student’s education level and age are not significantly associated with the probability of getting certified in developing countries.

With respect to our complete model, which contains both developing and developed countries, we observe that country-level infrastructural variable; internet bandwidth and Hofstede’s uncertainty avoidance cultural dimension are positively associated with the probability of getting certified in MOOC environment and have the postulated effects. With respect to individual level variables, we observe that age, gender, education level and the institution attended are significantly related with the probability of getting certified in MOOC.

Research Limitations and Future Research

Our preliminary analysis is only limited to secondary data from Harvard and MIT, two of the premier institutions, which have been leading the MOOC implementation in the world. Hence, results shall be interpreted with caution. Furthermore, we shall note that the number of institutions; public and private have been increasing hence our inferences may not be applicable to this growing universe. Furthermore, we use Hofstede’s cultural dimensions, which are measured at the national level. Despite many criticism of Hofstede’s model, Minkov and Hofstede (2011) emphasize that national culture and its dimensions are still relevant. However, we plan to experiment with other cultural models such as Schwartz’s Cultural Value Types, GLOBE as well as Inglehart’s Achievement and Motivation Index to evaluate the effect of cultural values (individually espoused values or national) on MOOC use and certification success. Furthermore, we plan to incorporate other non-ICT related factors, such as MOOC structure since these may impact the certification success as well.

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