A Framework to analyze effectiveness of eLearning in MOOC:Learners perspective

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Abstract—**Effectiveness in eLearning is identified as meeting the users' learning goals. It has been the subject of many researches which have led to a variety of dimensions and factors affecting it. However with the latest disruption of educational technology, MOOC has changed the perceptions of eLearning by taking eLearning to a new direction. Hence effectiveness dimensions & factors revealed before the introduction of MOOC required revising in order to cater to the new demands of eLearning in MOOC. At the same time there are many MOOC platforms introduced to the market leading to a potential issue of quality as not all the MOOCs provide effective results. Users are required to identify the effectiveness of MOOC. In searching for the solution to above problem, our research revealed a 10 dimensional framework for analyzing the effectiveness of eLearning in MOOC. Those are namely interactivity, pedagogy, collaboration, usability, network of opportunity, motivation, technology, content, support for learner and assessment. The framework was built using an instrument and tested with a sample size of 121 MOOC participants. Empirical results demonstrated that the instrument is within the acceptable range of verification and validation values. Therefore the 10 dimensional effectiveness framework assists as a benchmark for MOOC stakeholders.**

Keywords—eLearning; MOOC; effectiveness; framework, dimensions

I. INTRODUCTION

Technologies for education have been working hand in hand to cater the needs of users. Among many, the latest disruption in eLearning context is MOOC (Massive Open Online Courses). Unlike typical eLearning, MOOCs have their unique features as a result of their massiveness and openness. Although origination of MOOC was in 2008, New York Times pronounced 2012 as the year of MOOC [1]. This was mainly due to major MOOC providers such as Cousera, Udacity, edX starting to acquire a considerable market segment in 2012. Since then, there have been many MOOC providers who came into the market. Researchers have been focusing on development of MOOCs with regard to social, conceptual, technological and mostly business models [2]. Many MOOC providers revealed that they are facing higher dropout rates and it was identified as a common percentage of 13% as stated by [3].At the same time a systematic literature review conducted by [4], found there has been a gap in the researches of not identifying the learners perspective behaviors and pattern in MOOCs as well as the best practices of MOOC. With a higher rate of emerging MOOCs, the importance of identifying quality factors in a MOOC rises with the demand from stakeholders. Users are required to identify which MOOC provider offers the most effective results or best meets the learners' goals in learning. Although there has been considerable research behind the effectiveness of eLearning, not many of the researches focused on learning in MOOC. Working toward the direction to identify effectiveness of learning in MOOC, our research focused on 10 dimensions identified preliminarily. The dimensions were framed and factors were identified to form the effectiveness of a MOOC.

In this paper we explain the process of identifying the framework to analyze effectiveness of MOOC. The paper is organized so that first we explain the objective of the research. The literature review section explains the past frameworks. Third we explain the methodology of building the framework followed by the data analysis and discussion part in section IV. Lastly, the sections V and VI explain the limitations, future work and conclusions of the findings.

II. OBJECTIVE

The main objective of this research is to identify a framework where users will be able to explore effectiveness of a MOOC. This is due to the fact that many MOOC providers emerged into the market and not all the MOOC courses or platforms provide effective results. At the same time it is important to any MOOC provider to listen to the users and provide an efficient service. It is important to identify the dimensions and related factors where stakeholders could focus on succeeding in their goals.

III. LITERATURE REVIEW

Frameworks defining eLearning effectiveness have been researched by [5] [6] [7]. Many frameworks have not been tested for reliability and validity. Nevertheless the framework revealed by Ehler [8] has empirically identified seven key factors of eLearning. According to his findings, the European eLearning participants value the process of eLearning, such as presence, didactics and collaboration as being more important than institutional considerations such as vision, planning and finance in assessing. These findings indicate that there can be an important difference between learners and providers regarding the concept of effectiveness. At the same time it was revealed that there is a need for further investigation into the learners' views of effectiveness. Despite these findings in effeteness of eLearning, our argument is that it lacks focusing on the MOOC participants in particular. It is mainly due to the fact that MOOCs contain unique features, such as their openness and pedagogical design. Hence the previous findings

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on effectiveness would not provide adequate results in the context of MOOC.

It was important to identify the previous researches conducted using MOOC participants. Moving in that direction, the research conducted by Yousuf and Wosnitza [9] used MOOC participants to find the factors leading to successful MOOC. His research identified 6 categories explained by 74 criteria. The categories were verified and validated by an instrument using 107 MOOC students and 98 professors. However these criteria were selected from the perspective of technology and pedagogical dimensions. Our emphasis was to identify the dimensions from the learner's perspective. The dimensions were not limited to technological and pedagogical perspectives. This research explored broadly taking the learners perspective without being limited to any specific aspects.

Schulmeister [10], stated that MOOC model is yet to explore the social and learning aspects and concludes that face to face teaching has more effective results. Nevertheless, the research carried by [11], has stated that the MOOC is facing challenges of low level of student support and lack of a sound pedagogical approach. Their research framed 6 pedagogical principles and explained with 11 common pedagogical characters. However it is yet to verify and validate the framework.

IV. METHODOLOGY

In order to build the framework this research followed qualitative and qualitative methods. First phase was to identify the key dimensions and the second phase consisted of building an instrument to expand further the factors relating to the dimensions.

A. Intifying the dimensions of the framework

Since the concept of MOOC has emerged recently, the researches conducted on learner's perspectives of effectiveness were limited. At the same time, the previous researches on eLearning effectiveness may provide inconsistencies as it was not based on MOOC participants. Hence we in this research uniquely conducted preliminary data gathering based on Grounded Theory (GT) methodology.

We followed the steps in GT according to the research done by Galsers [12] who introduced GT. Our research gathers data by observations and semi structured interviews from 16 MOOC courses over a period of 2 years. Key dimensions are explained in the Table 1.

TABLE I. KEY DIMENSIONS

Key Dimensions	Description
1.Technology	How the introduction of new technology changed the eLearning perception
2.Pedagogy	Manner that course was designed to support the needs of the user
3. Motivation	How motivated the student was to take courses online
4.Usability	Is it user-friendly to access the platforms and media
5.Content/ Material	Are the materials up to date and do they meet the goals of learner
6.Support for Learners	Does the system or the platform accommodate users needs and support
7.Assesment	How the evaluation of courses is carried out
8.Future Directions	Recognition to the course and how the industry will look at what course achieved
9.Collaboration	Does it allow collaboration with peers and also the other interested networks
10.Interactivity	Does it allows enough interactions to keep the student engaged with the course

B. Instrument building

Designing of the survey instrument was based on 10 dimensions accompanied by 41 items resulting from the process of GT. A 5 point Likert scale was used, ranking 1 to 5 from lowest or disagreement to highest or high agreement.

C. Sampling & Data Collection

Samples were derived using the purposive sampling technique for the qualitative method, GT process and the delivery of the instrument. The students who take MOOC courses became our population and we purposely selected students who at least completed a MOOC course within 6 different MOOC platforms. Thirty students were highly selected for GT process and 210 students were selected to distribute the survey instrument. Selected MOOC platforms were Coursera, Iversity, edX, NovoEd, and futureLearn and the instruments were distributed via an online tool by posting the link in MOOC course forums. Only 121 responses were received with a response rate of 58%. Selected courses and the platforms are depicted in the Table 2.

TABLE II. MOOC COURSES AND PLATFORMS USED FOR DATA COLLECTION

Course	Platform
1.Foundations of virtual instructions	Coursera
2.Human Computer Interaction	Coursera
3. Advanced Instructional Strategies in the Virtual Classroom	Coursera
4.University Teaching	Coursera
5.Understanding research Methods	Coursera
6.Design Thinking	Iversity
7.Teaching Adult Learners	Open2learn
8.Leaders of Learning	edX
9. Technology Entrepreneurship I	NovoEd
10.Developing your research project	futureLearn
11.User Experience for Web	Open2Study
12.Creative Problem Solving	Coursera
13. Technology Entrepreneurship II	NovoEd

14.Entreprenourship 101	edX
15.Story telling for a change	NovoEd
16. Assessment and Teaching of 21st Century Skills	Coursera

V. Data Analysis& Discussion

The framework for effectiveness of eLearning in MOOC was required to demonstrate the consistency and validity necessary to be a good fit model. In order to accomplish the above, this research followed APA standards in designing and validating instruments and also used the techniques in SPSS - Exploratory Factor analysis (EFA), LISREL - Conformity Factor Analysis (CFA). The values obtained by the framework were analyzed in order to reveal the associations using techniques in SPSS. The list of items describing the dimensions is in Table 3.

TABLE III. Key Dimensions with components

Dimensions	**Components**	**Items**
1.Technology	HW support	TQ1
	SW support	TQ2
	Media	TQ3
	Mode of delivery	TQ4
2. Pedagogy	Learning process effective to learn connetivism	PQ1
	Learning reflects real world problems	PQ2
	Learning theories supported	PQ3
	Required face-to-face meetings Flexibility in learning pace	PQ4
	Methodology followed by lecturers design	PQ5
3. Motivation	Attention	MQ1
	Relevance	MQ2
	Confidence	MQ3
	Satisfaction	MQ4
4. Usability	interface design	UQ1
	learning environment	UQ2
	navigation	UQ3
	level of participation	UQ4
	interaction	UQ5
	feedback	UQ6
5. Content / Material	Relevancy	CQ1
	Updated	CQ2
	User Friendly	CQ3
6. Support for Learners	Psychological and social support for students	SQ1
	Administrative support	SQ2
	Student complaints procedure	SQ3
7. Network of Opportunity/Future direction	Learning support by peer network	NQ1
	Learning recognized by network of scholars	NQ2
	Opportunity to work with potential prospects	NQ3
8. Interactivity	Learner –Learner interactivity	IQ1
	Learner – Instructor interactivity	IQ2
	Learner- System interface interactivity	IQ3
	Learner –Content interactivity	IQ4
9. Assessment	Competency assessment	AQ1
	Collaboration assessment	AQ2
	Periodic course/program evaluation by various means, formative and summative	AQ3
	Periodic review of faculty/staff performances	AQ4
	Evaluation of student satisfaction levels	AQ5
	Regular review of student achievements	AQ6
10. Collaboration	With learners	CQ1
	With instructor's	CQ2
	With Faculty and other network	CQ3

A. *Content Validity of the instrument*

Content validity refers to the degree to which the scale items represent the domain of the construct. The first phase of the study was conducted using GT methodology. The results of the GT uniquely found 10 dimensions as stated in Table 3. The process of GT resulted in a unique dimension "Network of Opportunity" which was not addressed in previous researches. Though many of the MOOC courses did not carry any credentials, yet students were making an effort to complete the courses to make connections and opportunities in the subject interest they share. It was found that many courses failed to facilitate a rich network or encourage networking with each other in quest of new opportunities.

After processing data using the GT, all the measured items were developed and constructed based on extensive review of the literature and they were submitted to of eLearning specialists who were asked to judge the appropriateness of the items on the instrument.

B. Construct Validity of the instrument

TABLE IV. EFA ROATATED COMPONONT MATRIX

	PCA Factors									
	1	2	3	4	5	6	7	8	9	10
TQ1	.578									
TQ2	.639									
TQ3	.542									
TQ4	.892									
PQ1		.587								
PQ2		.790								
PQ3		.742								
PQ4		.630								
PQ5		.530								
MQ1			.587							
MQ2			.672							
MQ3			.735							
MQ4			.946							
UQ1				.539						
UQ2				.581						
UQ3				.679						
UQ4				.586						
UQ5				.649						
UQ6				.727						
CMQ1					.682					
CMQ2					.724					
CMQ3					.503					
SQ1						.547				
SQ2						.675				
SQ3						.521				
NQ1							.689			
NQ2							.611			
NQ3							.683			
IQ1							.	.617		
IQ2								.534		
IQ3								.557		
IQ4								.745		
AQ1									.525	
AQ2									.627	
AQ3									.643	
AQ4									.520	
AQ5									.513	
AQ6									.703	
CQ1										.647
CQ2										.709
CQ3										.594

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 13 iterations.

Construct validity was first examined by submitting each scale's items to an Exploratory Factor Analysis (EFA) in SPSS using Principal Component Analysis (PCA) procedure with varimax rotation to explore the underlying dimensions of the construct [13]. The usual cut-off point of 0.50 for item loading and eigenvalue of 1 were used. All sub-scales of perceived effectiveness dimensions showed adequate convergent validity as depicted in Table 4.

In every factor analysis run, each scale's items converged cleanly on the same factor representing these items. The factor analysis loaded in SPSS with 10 factors explained 67% of the variance. All factors loaded acceptably well and as shown in Table 5, KMO index is 0.849 and Bartlett's test of spehericity (approx. Chi-square = 1705; df = 105, Sig. = 0.000) Therefore, the construct validity of the survey results was fit to establish the constructs.

TABLE V. KMO AND BARTLETT'S TEST

Kaiser-Meyer-Olkin Measure of Sampling		.849
Bartlett's Test of Sphericity	Approx. Chi-Square	1705.865
	Df	105
	Sig.	.000

After EFA, the results were confirmed to be a good fit by the process of Conformity Factor Analysis (CFA) via LISREL. The statistics confirmed that the 10 factor model was appropriate to explain the effectiveness in eLearning. As depicted in Table 6, the goodness-of fit of the ten-factor model was evaluated. In LISREL, the Root Mean Square Error of Approximation (RMSEA) accounts for the complexity of the model and the degrees of freedom was calculated and the RMSEA cutoff was set at .05 or less[14]. The Incremental Fit Index (IFI), Comparative Fit Index (CFI), and Tucker-LewisIndex (TLI) were also used to evaluate the model fitting [15], [16], [17]. As depicted in Table V values of these indices are close to 1, and this indicates a very good fit between the data and the model. Goodness-of-fit measures of the study were RMSEA = .041, IFI = .920, TLI = .903, and CFI = .920, which indicates good fit of the 10-factor model to the observed data

TABLE VI: MEASURING GOODNESS OF FIT IN EFFECTIVENESS FRAMEWORK CFA

	Expected	**Results Value**
RMSEA	.05>	.041
IFI	Closer to 1	.920
TLI	Closer to 1	.903
CFI	Closer to 1	.920

C. Reliability of the Instrument

Although reliability can be measured in several ways, this research followed the internal consistency method. In this method, reliability can be estimated by means of a reliability coefficient, such as Cronbach's alpha, measuring the internal consistency of multidimensional scales [18]; this is the most widely used reliability estimate in empirical research [19]. As depicted in Table 6, the highest Cronbach's alpha was found

in the network of opportunity dimension and the lowest value was found in support for learner dimension. Nevertheless the acceptable reliability coefficient fell between 0.7 and 0.9, therefore, the measurement factors scales developed for this study were judged to be reliable since reliability coefficients of 0.7 or higher are considered satisfactory[5].

TABLE VI: RELIABILITY TEST RESULTS

Dimension	Cronbach's Alpha
1.Technology	0.783
2.Pedagogy	0.842
3.Motivation	0.789
4.Usability	0.724
5.Content	0.834
6.Support for Learner	0.705
7.Network of Opportunity	0.893
8.Assesment	0.722
9.Interactive	0.874
10.Collaborate	0.872

VI. DISCUSSION

Massive Open Online Courses (MOOC) plays a considerable role in educational technologies. The major advantage in the MOOC model can be considered to be it being a self-service & crowd source learning method. Although some MOOCs have shown effective results, many have failed to motivate students to complete the courses. It was argued that naïve learners needing instructional guidance are largely on their own and are no better off than in didactic learning environments where lectures are conducted in large lecture halls in a campus. Hence it was found that there is a major limitation of the MOOC model in providing a sophisticated learning architecture that effectively adapts to the individual needs of each learner [20].

The framework provided in our study will guide the MOOC model to focus on key areas where it directly affects the effectiveness of eLearning in MOOC. For example, we argue that many of the MOOC models have not considered about assisting the users to have a healthy relationship within among the learners network. It was found that many MOOC models fail to support collaborative achievements or group work in order to deliver an effective learning experience. At the same time many of the courses do not provide opportunities to network or provide leads to industry opportunities which were found to be very important factors for the students in the 21st century. These concepts are mapped in the Interactivity, Collaborativeness and Network of Opportunity dimensions in the framework.

At the same time, the framework includes the measurement factors to focus on a sound pedagogical model and supports assessment of the pedagogy. The students have to meet the 21st century challenges and they have to be well equipped by the learning experience. In that context, the pedagogical approaches supporting students to learn from each other play a valuable role. In many learning experiences it was found that effectiveness is guaranteed provided the real world problems in the learning environment are addressed [21]. Furthermore, this framework contains many other dimensions. In those, we tried to provide the aspects which students need to assess in a MOOC course in order to achieve successful results.

VII. LIMITATIONS AND FUTURE WORK

One of the major limitations is that this research utilized accompanied some traditional statistical methods (PCA in SPSS) to evaluate our data. In the future, other statistical methods such as big data analysis, neural networks may be employed to explore cause/effects relationship among variables. The next limitation is the fact that this research framed the effectiveness to 10 dimensions, whereas education by electronic means transforms the next generation learning to include new behaviors which may not be covered by these dimensions. Hence it could lead to new dimensions in which user may change the perspectives of existing dimensions.

As future work, our intention is to build a prototype of a platform using a design base research methodology which reflects the dimensions in the framework. The purpose of the new methodology is to use the real world testing in gathering the big data identifying the emerging behaviors.

VIII. CONCLUSION

This research attempted to provide a framework in order to identify the effectiveness of eLearning in MOOC as per view of the learners' perspective. Initially it has gathered data based on grounded theory and generated a framework which will be an aid to generate e a questionnaire to be distributed among online participants. The EFA, using PCA analysis in the framework, uniquely weighted the dimensions and CFA confirmed the framework to be a good fit to measure the effectiveness.

The Interactions, Collaborative aspects, Motivation were at first three priorities and next with the unique dimension; "Network of opportunities" leads the participants into a new dynamic way of learning online. Dimensions and the factors in the framework provided in Table IV will be a benchmark to solution providers in eLearning field. It is vital to address students' needs in the online environment as they will be the primary customers in the next generation education.

Finally we emphasize that the framework itself had a new dimension "Network of Opportunities"; unlike in the previous first generation eLearning researches, our work revealed that the students expect online courses to provide a more interactive, engage with collaborative environment while delivering adequate opportunities to meet new jobs, an equal recognition or more towards than just learning online. This includes the students' expectation from the course to provide additional links and networks of people where they could practice the learning and collaborate with industry.

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