Integration of Massive Open Online Education (MOOC) System with in-Classroom Interaction and Assessment and Accreditation: An extensive report from a pilot study

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Abstract : The advent of Massive Open Online Course (MOOC) in the arena of online education in the recent years has catapulted several novel ventures, both commercial and non-commercial, offering access to quality online courses at higher education level. MOOC, by its very definition, throws open the door of knowledge to any motivated individual learners anytime and anywhere for free, but having no formal accreditation attached to it. The new MOOC wave into the sea of higher education has obviously attracted an incredible number of individual learners in tens of thousands globally. Contrary to the notion of MOOC courses having no formal accreditation, the authors propose a clear purpose of participation and accreditation by transferring 'credits' of successful students towards completion of undergraduate degree program. This paper explores a possibility of integrating Winter 2013 DB Course, a MOOC course by Stanford University, for a group of students within a formal higher education institution in India combining classroom interaction, proctored evaluation of this online course and a clear purpose of transfer of credits towards completion of the home institution's "An Introduction to Database Management System Course". This paper presents a study of this experiment and its opportunities and challenges, and suggests recommendations for its effective implementation in the future.

Key Words: Massive Open Online Education (MOOC), Open Educational Resources (OER), Technology Enabled Teaching Learning, academic credentialing, Blended learning

1. Introduction

Modern digital and web technologies have opened up a plethora of revolutionary opportunities to enhance online teaching and learning experience. They redefine the domain of higher education. These developments have spawned new online 'disruptive' models to educate large number of students at college degree levels at no cost. One such disruptive model is Massive Open Online Course (MOOC), not so surprisingly termed by Forbes as the "Next Big Profitable Thing – the $1 Trillion Opportunity"[2], which has a huge potential to usher in new learning models, methods, and learners as a significant change agent in the current traditional education system. A survey by Babson Survey Research Group, Massachusetts, USA, in 2012, reveals the rate of growth in online education is significantly increased by ten times as against the 2 per cent growth rate in the overall all higher education student population. The survey further indicates that in USA alone over 6.7 million students are taking at least one online course as compared to previous year and 65 per cent of higher education institutions view that online learning is a critical part of their long term strategy[2]. This online revolution can benefit people who had previously no access to quality higher education at low cost. Interestingly, it is observed that almost one third of these massive online students are from non-US countries such as India, China and Brazil [9,10,16].

MOOC's amazing features are the large enrolment of thousands of motivated global learners, its efforts to make available free academic courses, and its scalability[9,13]. Though there is a huge rush in tens of thousands of people registering for MOOCs, the completion rate is rather dismal to mere 10 or less per cent.[9,10,13,22]. Though there are various factors contributing to this 'low' result, lack of time and formal accreditation as incentive for completion of MOOC courses are cited excuses [7]. In this context one of the authors (MJ) blended, on an experimental basis, the Stanford's Winter 2013 DB Course with campus classroom instruction in St., Xavier's College, Kolkata, with a clear purpose of deeper participation and transferring of credits towards the completion of a course titled "An Introduction to Database Management System" As part of this pilot study, the author(MJ) conducted key quizzes, assignment and exams of this MOOC course together with home institution's required exams in a proctored manner ensuring authenticity of

students engaged in online learning which is one of the key contentions related to MOOC courses [9,16]. This paper presents the pilot study and its opportunities and challenges. This paper first introduces the concept of MOOC and its characteristics, then explores related works implementing a hybrid model using MOOC, then highlights the details of pilot study and its opportunities and challenges, and finally draws conclusion and future scope.

2. Overview of Massive Open Online Education (MOOC)

The term MOOC stands for Massive Open Online Course. *Massive* refers to scale giving opportunity for connections among participants, *Open* doesn't mean just free but refers to open access, open syllabi and self-directed learning outcomes, *Online* points to making materials available on internet in abundance, and *Course* referring to structure of the online course[22, Dave Cromier in an MOOC and Business Plan discussion]. In other words, it is meant to "integrate the connectivity of social networking, the facilitation of an acknowledged expert in a field of study, and a collection of freely accessible online resources" [22]. A key characteristics of a MOOC is flexibility so that students can choose their level of participation in an "a la carte" manner without fees and any prerequisites other than internet access and interest, no predefined expectations for participation including no formal accreditation"[9,22].

The first MOOC was a course on "Connectivism and Connective Knowledge(CCK08)" in 2008 by George Siemens and Stephen Downes and is distinguished from other MOOCs as cMOOC. cMOOC means Connectivist-MOOC emphasizing on its distributed participatory networked learning [13,22, 23]. As MOOC is transitioning from "free education resources" to "scalable free courses" [9], many popular higher education institution ventured into MOOC such as MIT, Harvard, Stanford, UC Berkeley Princeton, University of Pennsylvania, Duke University, to name a few. MITx, edX (a joint initiative of MIT and Harvard), Coursera, Udacity and Udemy are platforms whose courses are termed as xMOOC. It provides typical instruction oriented online courses. Some of the other prominent MOOCs offered by Stanford faculty in fall 2011-courses were in Artificial Intelligence, Databases and Machine Learning. These trio courses attracted several hundreds of thousands of students crossing 300,000 together[10,32, 33].

It is further classified as network-based, Task-based and Content-based[21]. Network-based relies on connectivist-style methods of connection, constructing knowledge distributed on the open web platforms. While Task-based MOOCs focus on developing skills by emphasizing on completion of a set of outlined activities, Content-based MOOCs, offered by big universities and non/commercial entities for a large number of students with automated testing with a goal of acquisition of specific content.

As there are a large number of students taking MOOCs, there are varieties of student archetypes as well. They could be broadly categorized into four major types[7,17]. First, "lurkers/indifferent students" – they do not engage with others. Most of these students are registered with MOOC just to observe and watch a few videos and learning materials. Second, "passive students"- they view the course as a source of information and are expected 'to be taught' as in traditional in-classroom model and do not actively participate in activities such as class / forum discussions. Third, "partially engaged /Drop-In students" - they are interested in specific topics and direct most of their active participation within the course for that topic and do not complete the course. Fourth, "active/memorably engaged students"- set goals for themselves, get connected with others, peer grade others works and get engaged with materials in personal learning network especially using social media such as discussion forums, blogs, twitter, flickr, YouTube, etc.

However these archetypes are not static. Students may move from one to the other within a course or change over time from being passive to active participants or drop out and leave the course. Therefore, level and completion of MOOC courses largely depends on their motivation level, self-discipline and learning styles. There is no external pressure on them to complete courses. So the rate of completion of MOOC courses is at 10 per cent or less [10]. Some cited reasons include lack of time and other commitments in life, but importantly lack of incentives or recognition in terms of certificates and employment opportunities on completion [7].

The authors are concerned that all students should be encouraged to stay active at least through the entire duration of course by incorporating it within one's classroom environment as well as to integrate it within its assessment and grading system of the home institution. An experiment was carried out to test this idea into formal teaching-learning environment and is described in the following sections.

3. Some similar work as MOOC :

MOOC, by its definition, charges no fee and offers no certificates. Departing from this position, since the first ever MOOC was offered, it was informally practiced that a higher education institution which offers MOOCs is free to accept the credits of its successful students enrolled in a MOOC course. The first instance took place in the University of Manitoba, Canada, for 25 of its students enrolled in the CCK08 facilitated by George Siemens and Stephen Downes[22]. But it was also reported that a higher education institute which was not an organiser of a MOOC Course evaluated and accepted the credits of one of its student who took CCK08 [15]. Similarly the University of Freiburg, Germany, accepted credits of successful students of Stanford's CS221 Artificial Intelligence course and transferred the credits towards the completion of its course on Artificial Intelligence at the Department of Computer Science of the same university, after its own internal evaluation of its students [35]. The University of Helsinki, Finland, used the credits of a MOOC Course offered by itself, as part of admission process in their university in 2012 by acknowledging formal credits of CS1 Computer Science Course and admitting them into their own university[35].

In another interesting development in March 2012, Tony Hyun Kim[29] integrated edX's online materials with face-to-face teaching for a group of 20 teenagers in Ulan Bator, the capital of Mongolia, who were a tiny part of a huge 155,000 participants from 160 countries mainly from the US, India, UK, Columbia, Spain, Pakistan, Canada, Brazil, Greece and Mexico. The course was MIT's 6.002x on "Circuits and Electronics" and the results were amazing. Of these 20 students, 12 earned certificates of completion and 1 fifteen year old teen aced the course, that was, one of 320 students worldwide.

In a major variation from the traditional practices of credentialing of MOOC courses, in September 2012, edX[28] announced that students enrolled in its MOOC courses will have a choice of getting their learning validated with a proctored final exam administered by a third party. edX has named Pearson VUE Service for this purpose. This third party will charge a nominal fee for final academic evaluation service. However there is no evidence as to whether it is implemented. In yet another milestone move in the U.S., Colorado State University-Global Campus[24] has announced that it will transfer academic credits towards completion of a Bachelor's degree at the Global Campus for a Udacity course on "Introduction to Computer Science: Building a Search Engine". Apart from this, several universities in Austria and Germany[24] such as the University of Salzburg, the University of Freiburg, the Free University of Berlin, and the Technical University of Munich, have begun implementing transfer of credits for courses offered by Udacity. It should be noted that Udacity charges a nominal fee per course for issuing a certificate of completion which could be used in some of these universities for transfer of credits towards Bachelor degree[24].

The novelty of this pilot study is to make another leap towards integrating free quality online courses offered by xMOOC platforms into the academic system of traditional Universities and Colleges which will facilitate the evaluation and acceptance of such credits of their successful students within the home institution. This paper evaluates such an attempt in the next section of the paper.

3.1 The context and rationale of pilot study

The structure and method of offering MOOC could really benefit students learning in difficult situations where there is no access to consistent high quality higher education due to lack of qualified faculty, infrastructure and academic facilities, and high cost of higher education. This is a typical situation in the developing world. There is greater need for quality higher education in the developing world. Therefore it is obvious that one third of student population of many of the popular courses of MITx, edX, Udacity and Coursera, is from the developing world[16]. As against this reception of MOOC, there is a strong criticism on the low completion rate and the negative perception of the media hype about MOOC. In an interesting survey of 103 professors who taught a MOOC by the Chronicle of Higher Education[18] in March 2013, indicate only 28 per cent believe that students who succeed in their MOOC deserve a formal credit from their home institutions though 79 per cent believe that MOOC is 'worth the hype'. In a similar survey of Chief Academic Officers by Babson Survey Research Group[2], the recent estimate in 2012 stands at 30 per cent "accept the value and legitimacy of online education"

It is in this context, the authors propose to approach MOOC, not as a replacement of traditional in-class instruction, but rather to integrate selectively those courses which are in line with the academic courses of home institutions which are not organisers of any MOOC. This pilot study attempts to test the following research questions:

- Can students in traditional in-class instruction benefit from a new form of blended online learning by mixing local instruction together with MOOC content?
- What are the attitudes of students towards informal online learning as part of regular academic course?
- Can a higher education institution integrate quality MOOC courses and accept credits of successful online students towards completion of their bachelor's degree and to build a case to this end?

This study collected data from two surveys - a pre-MOOC and a post-MOOC survey. The pre-MOOC survey contained a series of 9 questions and was conducted prior to the start of Stanford's Winter 2013 DB Course to determine their initial attitude and readiness to take this MOOC course. The post-MOOC survey was carried out after the completion of the MOOC course with a series of 17 questions to primarily decipher the students' actual level of satisfaction, participation, performance, its impact and attitude towards transferring of their MOOC's marks to formal credits of a DBMS course in their home institution.

3.2 A Pilot Study made in-classroom environment:

**Table 1 Some Statistics of the Pilot Study**

Statistics	Informal[1]		Formal[2]	
	Participants	Percentage	Participants	Percentage
Total Participants	64127	-	35	-
Partial Assignment Completion	20836	32.5%	35	100%
Receipt of Statement of Accomplishment	4854	7.6%	25	71.4%
Receipt of Statement of Accomplishment with Distinction	1927	3.0%	2	5.7%

A pilot study was conducted incorporating the Stanford's Winter 2013 Databases Course (Winter2013 DB) in a traditional in-classroom environment in St. Xavier's College, Kolkata, a higher education institute in India. This winter 2013 DB is the second offering of Stanford, from January to March 2013, on Database Management Systems (DBMS) after the success of its first offer in fall 2011. A group of 35 students were formally registered for a course on Database Management System (DBMS). As a requirement, these students were also requested to register for Stanford's Winter 2013 DB course which could be used to complete an introductory course on DBMS of St. Xavier's College. Incidentally, Winter2013 DB online course's timeline aligned with the home institution's

Chart1: Transfer of MOOC Credits Towards Degree completion
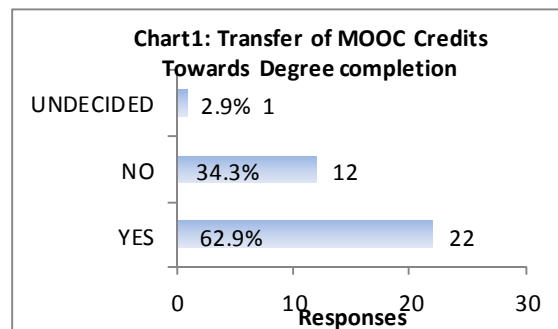
course exactly in the same semester.

Therefore it was easy to integrate Stanford's Winter 2013 DB course with the traditional classroom environment. Instead of the lecture format, the students and course teacher met every week for 2 hours to discuss on the Stanford's material that was due every week. Since the students were asked to go through the materials outside class hours, spending at least 2-3 hours a week, some spent even longer than 10 hours, relevant topics were discussed in a kind of "flipped classroom" set up. This enabled students to delve deeper into the depth of topics. This avoided presenting course

Chart2: Self-Assessment: Performance in MOOC
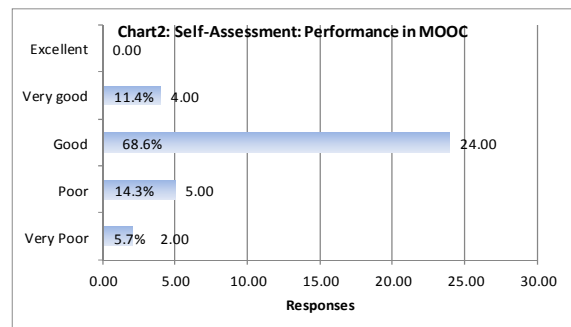
material in lecture format, except for a few hours on teaching prescribed topics which were not covered in the Winter 2013 DB course. As most of the students had already read up and watched video materials for the

week, it was much easier to explain and discuss issues which were not clear.

It is interesting to note the big difference under the "Turning in assignments" category, Informal Students (34.5%) as against Formal Students (100%) turning in some work in the Winter 2013 DB Course. The authors believe that the noticeable difference due to the expectation of students and the clear incentive system of transferring credits of this MOOC towards their completion of home institution's DBMS course, as indicated in the chart1 above on "Transfer of MOOC Credits to Academic Degree Completion". The other reason could be personal mentoring and guidance provided to the formal students during the entire duration of the Winter 2013 DB Online Course.

The chart3 below reveals that many students were satisfied with course content and the feature of online interaction with the other participants globally.

Chart3: What is your overall impression of the Winter 2013 DB Course?
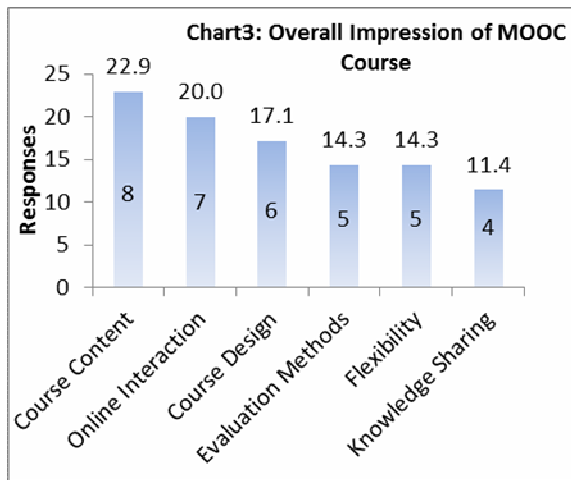
3.3 Opportunities and Challenges

From the perspective of participants of this pilot study, the authors briefly examine the opportunities and challenges of this pilot study. They are dealt with under these headings: Size of participants, Credentialing, Commitment, authenticity and personalization. They are briefly discussed below:

i. Number of participants:
A MOOC course is open to anyone. Anyone can take it anywhere. It provides an opportunity to go beyond one's class room, region, country and continent, out into global level of "borderless education" hearing global voice. If one is keen on getting connected with a diverse people, they are almost present virtually right there via various web platforms. On the other hand, the sheer size of people, 64127 registered learners in the Winter 2013 DB Course, could be very intimidating. Some students of this pilot study wondered how to get connected to so many thousands of students. More importantly, there is no scope for instructors to pay personal attention to anyone, no individual student get feedback from instructor either.

ii. Credentialing:
The content of the course is free for anyone's access. Departing from the initial notion of MOOC, a formal certificate could be offered to students who complete additional evaluation and are willing to make payment for administrative services [24,28]. The contention of the authors is that non-organizers of MOOC courses should be encouraged to adapt suitable MOOC courses and conduct necessary assessments of formal students and accordingly transfer credits towards completion of degree program. In this pilot study, it is towards the completion of the home institution's DBMS course. It is exciting to note in chart 1 that 62.9 per cent of students strongly agree to this proposal, while 34.2 per cent disagrees and 2.8 per cent is undecided on this issue. However one must keep in mind that currently there aren't many courses available which could fit into the existing curriculum structure of the home institution. Even those few MOOC courses may not match with the prescribed syllabi of non-organizers of MOOC courses.

iii. Commitment:

Table 2 Time Commitment for MOOC Course

1-2 hours	3-4 hours	5-6 hours	7-8 hours	10-12 hours
10	15	6	2	2
29%	43%	17%	6%	6%

This table presents the commitment of formal students in terms of number of hours. It indicates their weekly hours spent on this Winter 2013 DB course apart from the regular class hours on DBMS in the home institution. The authors believe that participating in a MOOC for a reward such as a formal certificate or credit transfer will enable students to be committed. It will help them to be committed to the course in terms of longer hours of learning and completing all assignments and timely participation in most online activities. The above table indicate that some students have put in as much as 10-12 hours. But there are students who get overwhelmed by the amount of energy and time it takes to get connected to open course. The survey data also shows that the self-assessment of the formal students on their participation in the Winter 2013 DB Course in terms of following all the study materials is at 60 per

cent, and on performance meaning completing all assignments and activities 68.5 per cent.

iv. Authenticity:

A MOOC provides a mechanism to record all the activities of students online and they are free to do what and how they want. At the same time, it is difficult to monitor all activities of students as they are free to access materials and perform assignments "anywhere and anytime". This is one of the majors concerns of MOOC's critiques. In this case study, key quizzes and exams were conducted proctored in the home institution. This assisted in ensuring the authenticity of students' activities and their academic performance.

v. Personalization:

In MOOC, students are encouraged to do learning at their own space selecting what is appropriate to them. Even though the online course could be exactly same course in the home institution, but the depth and breadth of subject, the learning style of learners and their contexts may be obstacles preventing them from taking any online course. It is really difficult to tailor the content to each individual student. However in this case study, topics which were not included in the online DB course was adequately discussed, while scaffolding students to learn materials provided in the online DB Course. Since the number of students was small, it was easy to mentor them individually. This, in turn, enhanced teacher-leaner personal relations as well as more active participation in the course.

vi. Attitudinal Change:

Chart 4: Attitudnal Change Towards MOOC
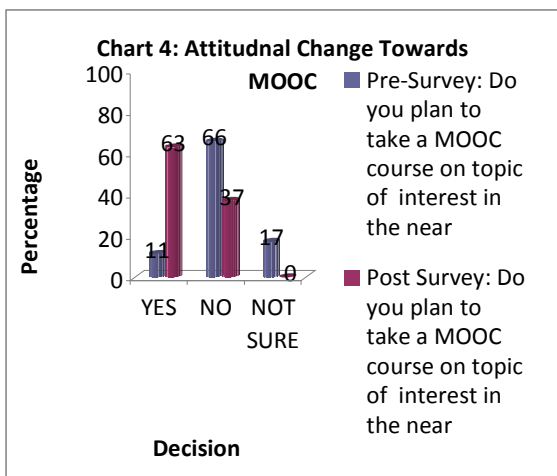
A key result of this pilot is that there has been a tremendous change in formal students' attitudes towards online learning, especially to MOOC courses. In the pre-survey which was conducted prior to the starting of

the Winter 2013 DB MOOC course, it was noticed that 66 per cent expressed the opinion that they don't plan to take a MOOC course/online course. This is contrary to the general notion that youngsters are enthusiastic online learners.

In the post-survey, response to the same question on attitudinal change, 60.per cent plans to take a MOOC course for personal learning in the near future. A 66 per cent strongly suggests that the home institution should offer MOOC courses at the earliest in the college campus.

4. Issues to be considered for formal MOOC integration

Based on the lessons learnt from this pilot study, the authors suggest the following.to fit a MOOC course into the context of higher education institution, especially in the developing world. Due to the brevity of this paper, they are briefly outlined below:

- *Academic Policy and Planning*
  - Academic policy to support integration of MOOC in the home institutions is crucial to ease the process of integrating new learning technologies and pedagogies in the traditional systems.
  - Criteria including academic integrity guidelines together with grading rubrics to gauge the level of competency attainment should be transparent.
  - Aligning timeline of MOOC and home institution's course timeline could be difficult if not well planned.
- *Infrastructure*
  - Basic infrastructure facilities such as access to internet connectivity and to quality online course materials are basic requirements.
- *Attitude*
  - Attitudes of students and staff to online learning teaching should be positive and be motivated to make use of existing MOOC courses.
- *ICT Skills*
  - Sufficient ICT Skills of both students and staff are required to do online activities, assignments and exams.
- *Assisting Students*
  - Effective mentoring and guidance is important to help students to actively engage in online courses.
  - A continuous positive feedback on the progress students is recommended.
  - Provide sufficient time to students to complete the tests/quizzes conducted by MOOC, as it

might require more time than proposed timeframe of MOOC course calendar.

• Providing learning materials in languages and cultures which are relevant to local context is highly encouraged.

4.1 Some recommendations:

The authors make a few recommendations which will aid non-MOOC organizers planning to integrate MOOC courses with their academic systems. Based on the experiment of this pilot study, the following recommendations highlight key aspects like facilitation, the role of teachers and assessment. These are briefly discussed below:

• **Facilitation**: The home institution must facilitate in two ways: infrastructure facility and instructors' role.

  o *Facilitation by the home institution*: The home institution should be committed to enhance infrastructure facilities such as PCs, robust network, internet access and library resources which will aid in the integration of a MOOC course within the campus.

  o *Instructors' Role:* This refers to the changed role of the teachers who will use MOOC courses within his/her academic course. The teachers should take on the role of mentor and guide, rather than instructor. This will help build healthy relationship among the teachers and students in online learning.

• **Flipped Classroom:** When appropriately MOOC courses are integrated, there will be extra class hours gained especially by avoiding lecture format classes. The extra class hours could be utilised positively for more interaction and in depth discussion of relevant topics. Activities like project or research work or creating knowledge artefacts could be introduced. Robert Beichner's "SCALE-UP" and Eric Mazur's[14] "peer instruction" could be of some help in this process of 'flipped classroom' scenario. This implies that teachers should participate in the 'flipped classroom' approach as learners so that they genuinely facilitate enriched learning in the classroom.

• **Proctored Assessment:** As discussed in the section 'Similar work on MOOC' in this paper, there are several ways of integrating MOOC courses within a home institution. The authors suggest a method in which a home institution integrates a MOOC course equivalent to its academic course. The home institution allows its students to get registered for these MOOC courses and assist them to engage with the online course materials and other participants globally. At the same time, the home institution can conduct important online quizzes and exams proctored manner so that it could be used for transferring of credits towards completion of specific courses. This also implies that formal students are not burdened with external evaluations and monetary payment. This however does not prevent capable students to take any external evaluation of MOOC course done by an external institution like Udacity.

5. Conclusion and Future Scope

Digital advancement provides many opportunities for enhancing online teaching and learning experiences. MOOC has brought in lots of innovative changes in the realm of higher education. MOOC provides access to quality online courses to anyone and anywhere at no cost. As MOOC continues to gain currency, many take up self-spaced online learning. However higher education institutions remain sceptical of MOOC's legitimacy as formal academic credit, as there is lack of authenticity of online leaners. To address this issue, this pilot study was conducted. It explored a new method of integrating MOOC in a higher education institution. In this method, a home institute combines face-to-face interaction as well as monitoring of key online quizzes and exams of MOOC courses. This will assist in establishing the authenticity of students' academic works which can be further assessed by the home institution's evaluation method. As a result, MOOC's credits of successful students could be counted towards completion of a specific home institution's course.

However there are challenges which need to be addressed such as infrastructure facilities, academic policy for accreditation of MOOC course, the role of teachers as mentor and guide, staff and students' attitudes towards online learning, specific plans to flip the classroom with learning activities, and proper assessment systems. An initial experiment could be cumbersome, but it is worth the effort to get a positive result. One such positive result is the change of attitudes of students to online learning. Now many students feel confident that they can take MOOC courses for their personal learning. They even suggest that the home institution should move in the direction of offering MOOC courses. It is important to have more evidences to build a case for this approach. Therefore the authors intend to continue similar experiments on other MOOC courses to augment more data evidence and apply it in an innovative blended learning in higher education.

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7. References

[1] Agariya, A. K. & Singh, D. (2012). e-Learning quality: Scale development and validation in Indian context. An International Journal of Knowledge Management and E-Learning. 4(4). 500-517. Retrieved form www.kmel-journal.org/ojs/index.php/online-publication

[2] Allen, I. E.,&Seaman, J.(2013 January). Changing Course – Ten Years of Tracking Online Education in the United States, Babson Survey Research Group, Massachusetts, USA

[3] Anderson, T., &Dron, J. (2012 September). Learning technologies through three generations of technology enhanced distance education pedagogy. European Journal of Open Distance and E-Learning. Retrieved from http://www.eurodl.org/

[4] Bacow, L. S., Bowen, W. G., Guthrie, K.M., Lack, K. A. & Lon, M. P. (2012 May). Barriers to adoption of online learning systems in U.S. Higher Education. ITHAKA S+R. Retrieved from http://www.sr.ithaka.org/research-publications/

[5] Bregar, L., Bavdoz, M., Orgrajensek, I. Papic, M., & Bester, J. (1999 December). On-line course: From experimental use to integration into a university programme. Retrieved from www.eurodl.org

[6] Bowen, W. G., Chingos, M. M., Lack, K. A., & Nygren, T.I. (2012 May). Interactive Learning Online at Public Universities: Evidence from Randomized Trails. ITHAKA S+R

[7] Chamberlin, L., &T. Parish, MOOCs: Massive Open Online Courses or Massive and Often Obtuse Courses?

[8] Christensen, C. M., Horn M. B., & Johnson, C. W. (2008). Disrupting Class – How disruptive innovation will change the way the world learns. MGraw Hill. New York

[9] Cooper, S., & Sahami, M. (2013 February). Reflections on Stanford's Moocs. Communication of ACM 56(2), 28-30

[10] Daniel, J. (2012 September). Making Sense of MOOCs: Musings in a Maze of Myth, Paradox and Possibility, KNOU

[11] Davidson, N. (2012, Dec 10). Size isn't everything, The Chronicle Review - The chronicle of Education, retrieved from http://chronicle.com

[12] Day, J., & Foley, J. (2006 November). Evaluating a web lecture intervention in a human-computer interaction course, IEEE Transactions on Education, 49(4)

[13] Educause. (2011 November). Seven Things you should know about MOOCs

[14] Fagen, A. P., C.H. Crouch, & E. Mazur. (2012). Peer Instruction: Results from a range of classrooms, The Physics Teacher, 40

[15] Fini, A. (2009 November). The technological dimension of a Massive Open Online course: The case of the CCK08course tools. The International Review of Research in Open and Distnace Learning. Retrieved from http://www.irrodl.org/index.php/irrodl/article/view/643/1402

[16] Hayman, P. (2012 December). In the year of Disruptive Education, Communication of the ACM 55(12), 20-22

[17] Hill, P. (2013 March). The four student archetypes emerging in MOOCs. E-Literate [Web log blog].Retrieved from http://mfeldstein.com/

[18] Kolowich, S. (2013, Mar 18). The minds behind the MOOCs. The Chronicle of Higher Education. Retrieved from http://chronicle.com

[19] Jahng, N., Krug, D., & Zhang, Z. (2007 January). Student Achievement in Online Distance Education Compared to Face-to-Face Education. European Journal of Open Distance and E-Learning. Retrieved from http://www.eurodl.org/

[20] Jung, M. L., Loria, K., Saha, R.M.P (2008). E-Learning: Investigating University Student's Acceptance of Technology. European Journal of Open Distance and E-Learning. Retrieved from http://www.eurodl.org/

[21] Lane, L. M. (2012). Three Classification of MOOCs, retrieved from http://lisahistory.net

[22] McAuley, A., Stewart, B., Siemens, G., &Cormier, D. (2010).The MOOC Model for Digital Practice.Retrieved from http://www.elearnspace.org

[23] Machun, P. A., & Wang, M. (2012). MOOCs: Is There An App For That?-Expanding Mobilegogy Through An Analysis Of MOOCs And iTunes University

[24] Mangan, K. (2012, Sep 6). A First for Udacity: a U.S. University will accept transfer credit for one of its courses, The Chronicle of Education, 6 September 2012 – retrieved from http://chronicle.com/article/

[25] Martin, F. G. (2012 August). Will massive open online courses change how we teach? Communications of the ACM 55(8)

[26] Morrison, D. (2013 March). A Tale of Two MOOCs @ Coursera: Divided by Pedagogy. Online Learning Insights [Web log blog]. Retrieved from http://onlinelearninginsights.wordpress.com

[27] Pantò E., Comas-Quinn A. (2013), The Challenge of Open Education, Journal of e-Learning and Knowledge Society, v.9, n.1, 11-22.

[28] Parry, M. (2013, Mar 20) edX Offers Proctored Exams for Open Online Course, http://chronicle.com

[29] Parry, M. (2012, Oct 1). 5 ways that edX could change education, The Chronicle of Higher Education, Retrieved from http://chronicle.com

[30] Piech, C., Sahami, M., Koller, D., Cooper, S. and Blikstein, P. (2012). Modeling how students learn to program. In Proceedings of the 43rd ACM Technical Symposium on Computer Science Education (SIGCSE '12). ACM. New York. 153–160

[31] Rajasingham, L. (2011 June). New Challenges Facing Universities in the Internet-Driven global Environment. European Journal of Open Distance and E-Learning. Retrieved from http://www.eurodl.org/

[32] Rodriguez, C. O. (2012 July). MOOCs and the AI-Stanford like courses: Two successful and distinct course format for Massive Open Online Courses. Retrieved from http://www.eurodl.org/

[33] Sahami, M., Martin, F. G., Guzial, M., &Parlante, N. (2013 March). The Revolution will be Televised: Perspectives on Massive Open Online Education. SIGCSE of ACM, 457-458.doi: 978-1-4503-1868-6/13/3

[34] Vardi, M.Y. (2012 Noember). Will MOOCs destroy academia? Commun. ACM 55(11), 5.

[35] Vihavainen, a., Luukkainen, & Kurhila, J. (2012 October). Multifacted support for MOOC in Programming. SIGITE'12 of ACM. 171-176. doi: 978-1-4503-1464-0