



Mooc on Horticulture

**MobiMOOC - a massive open
online course on horticulture - an
effectiveness study, Uttar Pradesh
State, INDIA**

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Report prepared for



COMMONWEALTH *of* LEARNING



MARCH 2015

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List of Abbreviations

IITK	Indian Institute of Technology, Kanpur
COL	Commonwealth of Learning
MOOC	Massive Open Online Course
OER	Open Educational Resources
ICT	Information and Communication Technology
IVR	Interactive Voice Response
CSAUA&T	Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, India
NDAUA&T	Narendra Dev University of Agriculture and Technology, Faizabad, India
MSKJUA&T	Manyavar Shri Kanshiram Ji University of Agriculture and Technology, Banda, India
CSJM	Chhatrapati Shahu Ji Maharaj University, Kanpur, India
BHU	Banaras Hindu University, Varanasi, India
CCS	Chaudhary Charan Singh University, Meerut, India
FGD	Focus Group Discussion
HTML	Hyper Text Markup Language
CMS	Content Management System
VOIP	Voice Over Internet Protocol
SD	Standard Deviation
CV	Coefficient of Variation

Executive summary

For six weeks beginning November 21, 2014, Indian Institute of Technology, Kanpur (IITK) and Commonwealth of Learning (COL) delivered a massive open online course (MOOC) on the horticultural crops over the mobile phone for the gardeners and agricultural students of the State of Uttar Pradesh, India. This report provides a comprehensive review of the MobiMOOC - a massive open online course on horticulture from the agricultural extension point of view. The report is intended to help in assisting IIT and COL staff to better understand the outcomes of the prototype course, the learners, their participation and performance, and their response to the course design.

KEY FINDINGS

Relevance

The IIT and COL MobiMOOC - a massive open online course on horticulture team have successfully demonstrated that offering mobile course in the field of agriculture did not have to use custom and “branded” MOOC platforms. A simple and easy to use technology based on Drupal open source software platform for delivery into with a basic, simple mobile phone was used successfully to provide a MOOC-style course to 1,055 practicing gardeners and agricultural students of Uttar Pradesh.

Successes and impacts

The course attracted 1,055 course registrants during its six-week timeframe. About 62.75 percent of the registrants (662) were active in the course space. A total of 296 learners were found eligible for receiving certificates of Competence. Certificates were awarded to approximately 45 per cent of active learners of the MobiMOOC - a massive open online course on horticulture. The top five districts in terms of registrants were *Kanpur, Kannauj, Aurariya, Etawah, and Faizabad*. Sixteen mobile handsets each of worth INR 2000 were also distributed among school students and practicing gardeners as an incentive for distinguished performance.

Design and delivery

The team demonstrated that developing an efficient technology that can make learning easier for the farming fraternity, teaching quality and content were critical factors in keeping participants interested in any online course. The team also demonstrated that high availability of online services in agriculture is a critical factor to sustain learners’ interest in a MOOC.

Cost-effectiveness

The MobiMOOC - a massive open online course on horticulture demonstrated that a low-cost, open source software delivery platform combined with open educational resources (OER) and a simple delivery over the mobile phones could be used effectively to provide a high quality MOOC environment that served around 1100 learners from farming community and agricultural students.

MobiMOOC - a massive open online course on horticulture - an effectiveness study, Uttar Pradesh State, INDIA

1. Background to the study

Agriculture is a complex enterprise involving millions of small and marginal farmers in India. Many of them are illiterate, resource-poor and have little or no access to modern technologies. Serving them with the latest agricultural information is therefore a very challenging task in Indian agriculture. Unless we find a solution that cuts across the problems of illiteracy and non-affordability of high end gadgets, the farming community will continue to remain without access to critical information. With the recent advances in Information and Communication Technologies (ICTs), bringing farming fraternity on a common platform and giving them real time, practical and cost effective agricultural information is not that difficult. Massive Open Online Course over a simple mobile phone could be an answer to all such questions.

MobiMOOC - a massive open online course on horticulture was designed, developed and implemented jointly by Indian Institute of Technology (IIT), Kanpur and Commonwealth of Learning (COL) on a comparatively large scale after two successful pilot testing on farmers and agricultural students. Using the concept of MOOC and combining it with basic mobile phones, IITK and COL have tried to educate agricultural community about 22 horticultural crops.

Assessing the worth of the course on important parameters is also felt important and necessary for further improvement. Hence, an evaluation was conducted and the course was judged on several parameters of extension.

This report provides a critical review from the point of view of extension for the MobiMOOC - a massive open online course on horticulture that was conducted over six weeks beginning November 21st, 2014 by IIT Kanpur and Commonwealth of Learning. It is intended that the review of the course design and delivery experiences will help IITK and COL to better understand the prototype course, its participants, their performance, and their responses to the course design.

The report begins with a background of the study (section 1) followed by context of the study in section 2 and MobiMOOC - a massive open online course on horticulture at a glance in section 3. Approach to the course review is discussed in section 4. Section 5 talks about the research approach to the investigation. Research findings and discussion is presented in section 6. Section 7 deals with the human interest stories captured during the investigation. Summary, study limitations, implications and major recommendations are discussed in section 8.

2. Context

Currently, the use of MOOCs is being tested in the context of expanding capacity to meet the growing demand for educational and learning content and services worldwide. Many of the world's leading higher education institutions are attempting to provide access to high quality

education for people around the world, including the disadvantaged and under-served. In this context, and drawing upon its experience in offering online courses on large scale in the field of agriculture in Indian context, the Commonwealth of Learning (COL) collaborated with the Indian Institute of Technology Kanpur (IITK) to experiment with MOOCs for the farming community and agricultural students. A six-week MobiMOOC - a massive open online course on horticulture was launched during 21st November 2014 to 31st December 2014. Its critical feature was that it was accessed by learners using just a basic cell phone.

MobiMOOC - a massive open online course on horticulture is an experimental technology based on Interactive Voice Response (IVR) and Open Source Soft Switch PBX system to disseminate audio lessons. The course was about sets of farming practices of 22 selected fruits, vegetables and flower crops being communicated in a pre-recorded audio format. Popularly known as voice-Package of Practices (<http://vkvk.iitk.ac.in/mobilecourse/>), these practices cover all aspects of cultivation from sowing up to harvesting.

A total of 1055 learners registered for this course 662 were active users and 296 completed the course, succeeded in the exam and were found eligible to receive certificates. It was a first course of its kind in Indian context. To know how effective this course was for the learners, an outcome study was planned and conducted in Uttar Pradesh region.

3. MobiMOOC - a massive open online course on horticulture - at a glance

MobiMOOC - a massive open online course on horticulture was intended for farmers/agricultural students/extension personnel/and anyone and everyone interested in agriculture. Primary goal for the MobiMOOC - a massive open online course on horticulture was to determine how best the online teaching via MOOCs and mobiles could be used to serve the development needs of the agricultural community of India. A team of eleven agricultural scientists, language experts, voice artists and technical support staff was involved back to back in designing, developing and executing the course. The audio content of 22 horticultural crops varying from four to seven minutes was prepared and delivered over learners' mobiles. Quizzes were provided on every weekend over the mobiles of the registered course learners. Learners were given course completion certificate jointly by the IITK and COL. The course completion includes assessment of two parameters: minimum 50 per cent of audio clips available in the course and scoring 50 per cent in the quizzes conducted. (Annexure I)

4. Approach to the course review

Both IITK and COL decided to generate process documentation and conduct an outcome evaluation of the MobiMOOC - a massive open online course on horticulture based on the principles of agricultural extension. This report contains the observations and inferences from such an evaluation.

The following aspects are documented, reviewed and reported here:

Section A: Course results

Section B: Feedback from the course learners

- Inputs used in design, development and implementation of MobiMOOC - a massive open online course on horticulture
- Activities completed and products developed
- Extent of awareness and information sharing behaviour of the course learners
- Gratification of learners from the services of MobiMOOC - a massive open online course on horticulture
- Opinion of course learners about the content relevance and usability features
- Constraints faced by the course learners

Section C: Feedback from the non-participants and drop outs

Section D: Feedback from the course development team

5. Research approach to the study

A sound methodology is a pre-requisite for accurate results from any research investigation. After reviewing the available literature related to the study, a scientific and systematic procedure was developed and adopted for conducting the investigation.

A judicious mix of both primary and secondary data were collected and used for the study. The respondents of the study included practicing gardeners of in and around of IIT-Kanpur, graduates of agriculture and horticulture of Chandra Shekhar Azad University of Agriculture and Technology – Kanpur, non-participants: those who were never exposed to any lesson of MobiMOOC - a massive open online course on horticulture and drop outs of the course, who registered for the course but could not complete it . Initially Students of Classes 10th and 12th (in the curriculum of UP State Board of Education) were also the part of the final sample but they could not be contacted due to some unavoidable reasons. The report is also supported by secondary sources like project proposal, programme reviews, occasional papers and MobiMOOC - a massive open online course on horticulture website.

Locale: The investigation was carried out in the state of Uttar Pradesh, India. The course was popular in three agricultural universities (CSAUA&T-Kanpur, NDAUA&T-Faizabad and MSKJUA&T-Banda), three universities where agriculture is a major subject (BHU-Varanasi, CCS University-Meerut and CSJM-Kanpur) six schools (Janta Mahavidyalaya, Ajitmal, Auraiya; Janta Inter College, Ajitmal, Auraiya; Lokmanya Rural Inter College, Mahewa, Etawah; Durga Narayan Inter College, Tirwa, Kannauj; KK Inter College, Kannauj; and National Inter College, Maudha, Hamirpur) and practicing gardeners of in and around the campus of Indian Institute of Technology, Kanpur. Keeping in mind the time, money and resource factors, a representative sample of agricultural graduates and gardeners from Kanpur area was drawn and interviewed for the study. A total of 61 respondents were contacted for the study.

i. Sampling

Selection of the respondents for present study was done at three levels:

Level I: Selection of course learners (agriculture graduates and practicing gardeners)

If the population from which a sample is to be drawn does not constitute a homogenous group, then stratified sampling technique is applied (Kothari, 2012). Stratified sampling is a kind of

probability sampling, where the population is divided into strata such as men and women, black and white and the like, from which random samples are drawn (Kerlinger, 2010). Course learners (respondents) for MobiMOOC - a massive open online course on horticulture were heterogeneous and this could be divided into two strata: (1) students of the agricultural universities and (2) practicing gardeners (*Malis*). Therefore, a representative sample of 22 practicing gardeners and 20 agricultural graduates was drawn from each stratum using the stratified random sampling technique.

Level II: Selection of course designers (Experts from IIT-Kanpur)

At this level eleven course designers from IIT-Kanpur were selected through census method but ten of them finally responded to the questionnaire.

Level III: Selection of non-participants and drop outs

At this level, ten respondents of the similar socio-economic and geo-graphical conditions, who were never exposed to MobiMOOC - a massive open online course on horticulture, were interviewed. The purpose of selecting this group was to find out if the MobiMOOC - a massive open online course on horticulture has really made any difference in the life of those who had undergone and completed the course. The comparison was mainly done on the basis of knowledge level and practice change.

The study focuses on active participants but concentrated more on those who were eligible for certificates. A few that were active but did not receive certificates, also included in the sample to know the reasons for their drop out or discontinuance. Eleven course drop outs were randomly sampled and interviewed for the present study.

In total ten course designers and 63 course learners (42 active learners, 11 drop outs and 10 non-participants) made the sample for the present study.

ii. Research design

Appropriate research design is the prime need of any research investigation. It is the arrangement of conditions for the collection and analysis of data in a manner that aims to combine relevance to the research purpose with the economy in procedure (Kerlinger, 2010). Descriptive research design was used to assess the effectiveness of MobiMOOC - a massive open online course on horticulture course on selected parameters. At the time of assessment the course was only few months old hence, for measuring the effectiveness of MobiMOOC - a massive open online course on horticulture, the focus was more on process documentation rather than on end results. Process evaluation examines the procedures and tasks involved in implementing a program. It monitors the program to ensure feedback during the course of the program.

For measuring the effectiveness of MobiMOOC - a massive open online course on horticulture several evaluation models were reviewed viz. CIPP (Context, Input, Process, Product) evaluation model, Daniel Stufflebeam's, CIRO (Context, Input, Reaction, Outcome), Scriven's Goal-Free Evaluation Approach, Suchman's Logic Approach Model, Heeks' (2005) Information Chain Model, an Extended Framework for Investigating ICT Impact Towards Development, Social Impact Assessment (Vanclay, 2003), Measuring Impact model (NCVO,

2003), Program Action Logic model, Participatory Impact Pathways Analysis (PIPA, 2006), TOP (Targeting Outcomes of Programs) model (1995), SECTION framework (Bates and Poole, 2003) and Bennett Hierarchy Seven Step Model of Planning and Evaluation (1976).

Out of these, seven steps Bennett Hierarchy Model of Planning and Evaluation (1976) was found suitable for the present investigation and was adapted with some modifications.

iii. Bennett Hierarchy’s Model of Planning and Evaluation (1976)

Bennett Hierarchy model of planning and evaluation (1976) has been extensively used by extension practitioners for planning and evaluation. The Bennett Hierarchy (Table 1) describes a series of staircase levels of evidence of program impacts, beginning at the bottom step with “inputs” i. e. allocation of resources to a program and progressing to the top, “end results” i. e. measuring impacts of the program on long term goals or conditions.

Table 1: Bennett’s Hierarchy applied to the effectiveness of MobiMOOC - a massive open online course on horticulture

Evaluation Hierarchy	Measurement in the present study	Indicators
Level 7 (Gratification)	Level of satisfaction	Level of satisfaction
*Level 6 (Practice change)	Change in behaviour	Levels of adoption
Level 5 (Knowledge level)	Knowledge level of respondents	Knowledge level of respondents
Level 4 (Reactions)	Opinion of respondents	Opinion about features, content relevance and usability features of MobiMOOC - a massive open online course on horticulture
Level 3 (Outputs)	Activities completed and products developed	Activities performed by key stakeholders, number of participants, their profile, and products developed
Level 2 (Activities)	What MOOCs offer or do	Assigned activities of key stakeholders
Level 1 (Inputs)	Resources used	Total money spent, Human resource involved, numbers of scientists, number of technical persons, number of registered participants

***Behavioural change is a long term effect which could only be measured after a long gap of the program/course implementation. It’s hardly 6 months when MOOCs on Horticulture was executed, thus, this step was skipped from the present study. However, researcher had tried to report few cases of practice change.**

iv. Tools for data collection

A judicious mix of qualitative and quantitative data was collected by using a variety of tools. Primary and secondary sources were used for a comprehensive documentation. While primary sources provide first-hand information, secondary data are those already recorded for some other purpose but used in research. Data collection tools were prepared by giving due consideration to various variables, objectives and respondents.

Based on the understanding of facts and related reviews, a structured interview schedule was developed to investigate various dimensions of the study (consisting general profile, extent of awareness, course structure, outputs of the course, knowledge and extent of adoption of the advices, opinion of stakeholders, information sharing behaviour of course learners, gratification of the services of MOOC's course and immediacy of feedback from experts, learners feedback, feedback from the development team, constraints faced in accessing MOOCs course etc). In brief the interview schedule was a mix of general profile items, knowledge test, opinionnaire and learners' feedback.

Two focus group discussions (one for each strata i.e agricultural graduates and practicing gardeners) were also be conducted for the cross discussion and comparative reasoning of the study outcomes. Case study approach was followed to capture human interest stories. A structured mailed questionnaire was also used to collect data and feedback from the course designers.

Secondary sources were used to collect information about total human resource involved, course cost, inputs used and the activities of key stakeholders of the MOOCs on Horticulture course and products developed during the course duration.

v. Item analysis

After a preliminary selection and editing of items twelve major areas and different sub-areas delineated initially were subjected to item analysis. The items were subjected to judgment by a panel of 5 extension experts. Interview schedule was sent to the experts via electronic mail. Judges were requested to go through the items and indicate the significance of all the items on a three point continuum as "Highly relevant", "Relevant" and "Irrelevant" with corresponding scores of 3, 2, and 1 respectively. The relevance percentage of more than 75 was used as cutting point while screening and consideration for selection of the major areas and their sub areas in the final interview schedule.

vi. Types of documentation

Log book was used to document experiences and specific observations while interviewing and FGD. Photographs and video recording were also taken to supplement the responses. The collected data was tabulated and analysed using appropriate statistical tools.

6. RESEARCH FINDINGS AND DISCUSSION

This section deals with research findings of the study together with relevant discussion on the facts. Findings of the study have been presented and inferences were drawn from them in relation to specific objectives of the study set forth. Findings of the study are presented under following subheads:

Section A: Course results

Section B: Feedback from the course learners

- Inputs used in design, development and implementation of MobiMOOC - a massive open online course on horticulture
-

- Activities completed and products developed
- Extent of awareness and information sharing behaviour of the course learners
- Gratification of learners from the services of MobiMOOC - a massive open online course on horticulture
- Opinion of course learners about the content relevance and usability features
- Constraints faced by the course learners

Section C: Feedback from the non-participants and drop outs

Section D: Feedback from the course development team

SECTION A

a. COURSE RESULTS

The course began with 1,055 course registrants, from which 662 registrants were considered active participants in the course during its six-week timeframe.

i. Students

Detailed individual demographics of the course participants are discussed in the next section, yet the following summary data provides a high-level snapshot of course participants and their participation level:

- The course attracted 1,055 registrants from the whole of Uttar Pradesh state.
- The number of female registrants (08) were less than 1 percent (0.76 per cent) of the total registrants (1055).
- About 62.75 percent of the registrants (662) were active in the course space.
- A total of 296 participants were found eligible for receiving certificates of Competence. Certificates were awarded to approximately 45% of active participants in the MobiMOOC - a massive open online course on horticulture.
- The top five districts in terms of registrants were *Kanpur, Kannauj, Aurariya, Etawah, and Faizabad*.
- Sixteen mobile handsets each of worth INR 2000 were distributed among school students and practicing gardeners as a promotional activity.

The negligible participation of women in the entire course duration might be due the traditional social set up of the region where women are still supposed to be in the four walls. The other reason could be the strong belief that men hold the supreme power over the possession and use of modern technology.

ii. Course

- During the four weeks' course 22 horticultural crops (potato, tomato, vegetable pea, brinjal, cauliflower, radish, carrot, rose, marigold, jasmine, chrysanthemum, gladiolus, mango, guava, banana, gooseberry, papaya, fenugreek, coriander, chilli, garlic and

onion) which are grown in winters in UP region were selected for the MobiMOOC - a massive open online course on horticulture.

- A total of 2 hours and 13 seconds educational audio material on the above mentioned crops was developed during the entire course duration. A detailed description of crops covered with duration (in minutes) is presented in Table 2:

Week 1 (Vegetable Crops)		Week 2 (Flower Crops)	
Potato crop production	6:21	Rose crop production	7:01
Tomato crop production	5:56	Marigold crop production	5:41
Vegetable pea crop production	5:38	Jasmine crop production	5:15
Brinjal crop production	5:38	Chrysanthemum crop production	5:53
Cauliflower crop production	5:23	Gladiolus crop production	4:55
Radish crop production	4:04		
Carrot crop production	4:11		
Week 3 (Fruit Crops)		Week 4 (Spice Crops)	
Mango crop production	6:38	Fenugreek crop production	5:31
Guava crop production	5:25	Coriander crop production	4:48
Banana crop production	6:30	Chilly crop production	4:25
Gooseberry crop production	6:38	Garlic crop production	4:51
Papaya crop production	5:15	Onion crop production	4:11
Total hrs.		2:00:13	

- Each crop had nine audio clips totalling to four to seven minutes with each clip of an average duration of 15 to 60 seconds. Lessons included a complete package about the crop right from seed sowing till harvesting. As Hindi is the national language of India and mostly people speak and understand it hence, Hindi with local terminologies was used to deliver the information to the learners.

Comment [VB1]: Worth mentioning that every crop had nine or so audio clips totalling so many minutes with each clip of an average duration of 35-45 seconds. This is useful and important.

iii. Inputs used in design, development and implementation of MobiMOOC - a massive open online course on horticulture

It can be operationalized as total money spent in various phases of construction and implementation of MobiMOOC - a massive open online course on horticulture.

According to IITK sources, total money spent on designing, popularization and implementation of MobiMOOC - a massive open online course on horticulture was INR 800,000 (excluding time value of human resources). The total amount spent includes amount paid to design and develop the MobiMOOC - a massive open online course on horticulture course lessons and delivery platform, money spent for conducting trainings, call charges for the delivery of lessons to all learners over mobiles and certificate distribution. Total eleven human resources from IIT-Kanpur were involved during the entire course. This includes four agricultural scientists, four technology experts, two language and recording experts and one expert was outsourced for recording.

The findings on financial resources used to run MobiMOOC - a massive open online course on horticulture suggest that even with limited cost available, such courses could be successfully developed and implemented.

Activities and Outputs of stakeholders

a. Agricultural scientists

Activity

- All four agricultural scientists thoroughly reviewed the available literature especially Handbook of Horticulture and *Krishi Gyan Manjusha* (7th ed) that are used at national level for the horticultural information.
- Then the crops and content were carefully selected and customized for the region. Content was then created in Hindi (local) language for maximum penetration and understanding among the intended users.
- Agricultural scientists also developed the quiz for each crop which was to be asked at every weekend. This was done to see if the lessons were properly designed and if the users could understand and retain it for longer time.
- Another major activity of agricultural scientists was audio recording of the content in the form of short lessons. Those audios were later sent to all the registered users as lessons.

Output

- As a result of agricultural scientists' activities a 2 hours 13 seconds audio material containing complete information of 22 fruits/vegetables/flower crops was developed and hosted on <http://vkvk.iitk.ac.in/mobilecourse/>.
- The same content was also made available on MobiMOOC - a massive open online course on horticulture website (<http://vkvk.iitk.ac.in/mobilecourse/>) in the form of HTML. Therefore, the content can be rerecorded whenever needed.
- Publication: There was an article published in *Antas* Hindi magazine of IIT Kanpur <http://www.iitk.ac.in/new/data/Antas/antas2015-7.pdf>

As very few things changes in agricultural operations excepts for crop varieties and fertilizer doses hence, these audios could again and again be used for any such courses in near future.

b. Technical team

Activities

- The technical team of four experts reviewed and exhausted the available options to develop the best possible platform which was capable enough to handle the pressure during the peak period.

Comment [KY2]: Yes, this leads to home page and only those who have login credentials could see other details. I thought of creating a login for myself but since the course is over thus, no one can register to the site. I am not sure as how to address this issue.

Comment [VB3]: This link leads to just a registration page not to any info

- A two components technical platform was designed and developed for content creation and delivery. First component was an instructor part which was built using Drupal CMS and VIOP Drupal framework that helped in the delivery mechanism.
- Technical script of the course was designed that allowed users to access the course through mobile phones.
- Surveillance and maintenance of the technical platform was one of the major and full time activity of the technical team. This involved removing any advertisement from the website, if there was any, creating the database of the registered users, hosting HTML and audio content on to the website and assuring the smooth functioning of the delivery platform.
- All the recorded audio files were edited before final hosting and airing.

Output

- A dedicated website for MobiMOOC - a massive open online course on horticulture (www.mobimooc.in) was developed to keep a database of all the users and all the lessons developed during the entire course.
- A delivery platform was also developed through which agricultural information was disseminated over the mobiles of the registered users of MobiMOOC - a massive open online course on horticulture. A dedicated number (0512-3090900) was given to all the users to get the lessons on all 22 horticultural crops.

c. Others, if any

Activity

One recording expert was outsourced to help the agricultural team in recording the lessons.

SECTION – B

FEEDBACK FROM COURSE LEARNERS

22 practicing gardeners within the IIT Kanpur campus and 20 agricultural/horticultural graduates of CSAUA&T, Kanpur were interviewed personally after the course was completed. A total of 42 responses from those who had completed the course, appeared in the exam and received the certificates were collected. Learners were asked open ended, dichotomous, multiple responses, opinions, ranking and rating type of questions. For rating type of questions, learners were provided with a three-point scale with which to provide a numeric answer, with 1 being the lowest rating and 3 being highest rating. The questions, student ratings, rankings, opinions and averages for numeric ratings are provided in the tables below.

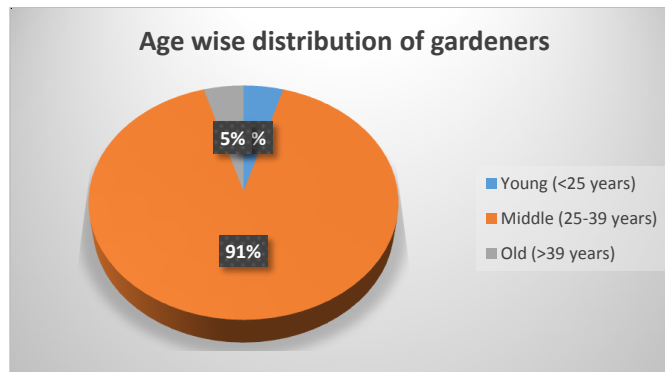
FARMERS SURVEY RESPONSES TO QUESTIONS REQUIRING A NUMERIC RATING

Table 3: Age (N=22)

Age category	Frequency	Percentage
Young (<25 years)	01	4.55
Middle (25-39 years)	20	90.9
Old (>39 years)	01	4.55

Mean = 32.32 SD = 7.01 CV = 21.69

A perusal of Table 3 reveals that the majority of farmer respondents (90.9 per cent) were found to be in the middle age category (between 25-39 years). There was only one practicing gardener who was 50 years old (4.55 per cent). This can be concluded that comparatively younger age group people tend to be more technology savvy and would like to make use of cosmopolitan sources to get agricultural information. They are high risk takers and their ability to understand and apply complex technical knowledge is also higher as compare to the old age people. They can play an important role in the diffusion of any such innovation like launching the new idea in the system by importing the innovation from outside of the system's boundaries. Thus, the innovator plays a gatekeeping role in the flow of new ideas into a system (Rogers, 2003). The SD (7.01) and CV (21.69) values further suggest that farmers were largely homogeneous with respect to their age (Fig 1).

**Figure 1****Table 4: Education (N=22)**

Educational status	Frequency	Percentage
Illiterate	04	18.18
Primary	07	31.18
Middle school	01	4.55
High School	09	40.90
Graduate and above	01	4.55

Data regarding education level of gardeners presented in Table 4 shows a diverse pattern of their educational status. Most of the gardeners were educated up to high school level (40.90 per cent) followed by those who have studied up to middle school (31.18 per cent). Table also evinces that where we have 18.18 per cent illiterate gardeners, we had a graduate gardener as well (Fig 2).

It can be concluded from the results that MobiMOOC - a massive open online course on horticulture mobile course was so efficiently designed and developed that a graduate and an illiterate both could use it simultaneously without any difficulty. MobiMOOC - a massive open online course on horticulture has cuts across the major issue of illiteracy in agricultural community. The learner should only have the basic mobile operating skills.

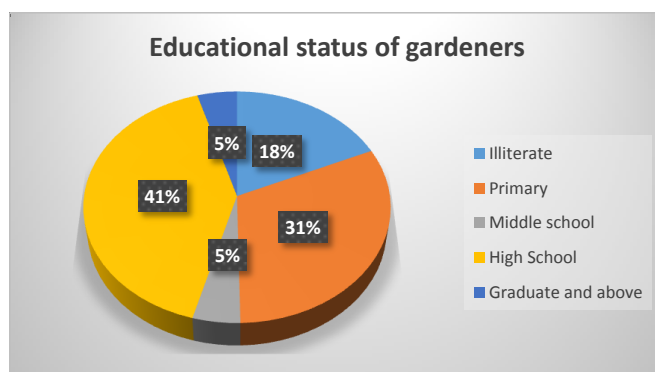


Figure 2

Where practicing gardeners differ slightly in age and educational status, agricultural graduates remained exactly similar to each other.

Gender

Out of 42 active course learners, there was only one female student. Whole course was dominated by the male learners. The results shows that although women are shouldering responsibilities with men in every facet of life yet males take a lead when it comes to use of modern technology. Results second the social system of a common Indian rural family, where male members dominate over females in arranging livelihood for their family and gets education and better nutrition. Women of the study region contributes a lot in agricultural activities still when it comes to go out of veils they are always restricted. Still it is appreciable to note that in such conditions too, females are trying to come forward to participate in use and application of modern technologies for agriculture.

Knowing this fact, extra efforts could have been taken by the development team to encourage women participation.

Table 5: Sources of information to the learners (N = 42)

The nature of sources through which farmers had come to know about the MobiMOOC - a massive open online course on horticulture course was studied. The sources of awareness might be course development team, friends and relatives, college notice boards, social media etc.

Question	Source of awareness	Percentage	
		Gardeners	Agri. graduates
How did you come to know about the MobiMOOC - a	MobiMOOC team	100	20.00

massive open online course on horticulture?			
	Friends	31.18	100

***Multiple responses were allowed**

While all the gardeners (100 per cent) came to know about the course through course development team, few of them (31.18 per cent) also got this information from friends. Friends (100 per cent) were the major source of information to the agricultural graduates of CSAUA&T-Kanpur. Very few came to know about it through the course development team. The reason could be that the gardeners were from the same campus, thus promotion and follow ups were easy for the course team. Team members could also make personal contacts with the gardeners that increased the admissions and resulted in almost no drop outs among gardeners. Whereas, the same was not possible with the agricultural graduates due to the physical distance and their busy class schedules. Thus, it can be concluded that course development team and friends had played a key role in spreading awareness among the gardeners and agricultural graduates.

Table 6: Information sharing behaviour of learners (N = 42)

Information sharing behaviour of the gardeners and agricultural graduates regarding the knowledge and information provided through MobiMOOC - a massive open online course on horticulture represents the extent to which the learners felt that these services should be enjoyed by all the members of society.

Question	Category	Percentage	
		Gardeners	Agri. graduates
Please indicate, whether you shared the information gathered through MobiMOOC - a massive open online course on horticulture or not? If yes, than with how many?	Shared	100	90.00
	Not shared	NIL	10.00
Number of persons with whom you shared information?	Six to ten	68.18	30.00*
	More than ten	31.18	60.00*
Nature of persons shared	Family/relatives	22.72	20.00*
	Fellow gardeners/students	77.27	70.00*

***Two agricultural graduates did not share the information with anyone hence, total doesn't add up to 100 per cent.**

After getting aware of the MobiMOOC - a massive open online course on horticulture, learners would either get satisfied or dissatisfied with the kind of services provided. If the results are satisfactory, there would surely be the information sharing about the services and recommendations of the course. The information sharing behaviour of learners about the MobiMOOC - a massive open online course on horticulture presented in Table 6 shows that an

overwhelming majority of gardeners and graduates (100 and 90 per cent respectively) had shared the information. It directly reflects upon the satisfaction that learners had earned out of the services and recommendations of horticulture extended to them. Hence, the course development team should ensure to sustain learners' interest by providing uninterrupted services and quality information recommendations at their door steps. Only a negligible number of agricultural graduates did not share this information with anyone. This might be because they could not find time or they wanted to hold the power of their knowledge only up to them.

It could be observed from Table 6 that majority (68.18 per cent) of gardeners shared with six to ten people followed by 31.18 per cent of those who shared with more than ten people. While majority (60.00 per cent) of agricultural graduates shared the information with more than ten people followed by 30.00 per cent who shared it with six to ten people.

The desire to promote awareness about the MobiMOOC - a massive open online course on horticulture might be one of the reasons for sharing the information to maximum number of people. Above all MobiMOOC - a massive open online course on horticulture offers free agro-advisory services to the agricultural fraternity on their mobile phones. Hence, maximum number of sharing was done with a view to motivate peer groups to utilize free horticultural services and enhance their knowledge about horticulture.

Another important reason could be the rewards and recognition. Most human beings need some incentives to share knowledge. Special rewards and incentives can act as extrinsic motivators, so that users are willing to share and transfer knowledge (Yadav and Sulaiman et al, 2014). In the specific case of MobiMOOC - a massive open online course on horticulture, it was easy to incentivise users by a simple reward of certifying their participation. Additionally, at present, certification offers direct personal benefit to the users, except for the inherent pleasure in sharing with others. What was being done by the course team, however, was to highlight the best performance by certifying and incentivise users.

Out of 100 per cent of the gardeners, who had shared the information about MobiMOOC - a massive open online course on horticulture, majority (77.27 per cent) had shared it with fellow gardeners followed by family members/relatives (22.72 per cent). The results are almost similar in case of agricultural graduates as majority (70 per cent) of them too shared this information with fellow students followed by family members/relatives (20 per cent). This might be because they spent maximum amount of time with them and meets very frequently at work place and college.

Table 7: Gratification of the services (N=42)

Question	Category	Percentage	
		Gardeners	Agri. graduates
Please indicate, whether you are satisfied with the services with the services of MobiMOOC - a massive open online course on horticulture or not on following criteria?			

a. Extent of utilization of knowledge gained	Utilized to fullest extent	63.63	35.00
	Utilized to medium extent	36.36	60.00
	Not utilized	NIL	5.00
b. Results of recommended practices	Satisfied	100	95.00
	Not satisfied	NIL	5.00

Gratification refers to the satisfaction of gardeners and agricultural graduates with regard to the results of adoption of practices recommended by MobiMOOC - a massive open online course on horticulture of and its overall services. If the practices recommended through MobiMOOC - a massive open online course on horticulture were found suitable to the farmers' condition and if the results produced positive results upon them, gratification would normally arise. When impractical and unsuitable and too general information are provided by the experts without customizing and probing much into the farmers' situations, the results might not fulfil the users' need and might end up with dissatisfaction.

While 63.63 per cent gardeners utilized the information gained through MobiMOOC - a massive open online course on horticulture to the fullest extent, 36.36 per cent utilized it to medium extent. Whereas only 35 percent of agricultural graduates utilized it to the fullest extent followed by the majority (60 per cent) of those who utilized it to the medium extent. It is clear from the perusal of the table 6 that almost all the learners (gardeners-100 per cent and agricultural students – 95 per cent) were satisfied with the recommendations and overall services of the course.

The reason for this result might be that the information provided by the experts was carefully prepared and perfectly customized for the course learners. Hence, it may be inferred that location specific, low-cost and quality services need to be prepared judiciously to yield maximum retention and satisfaction. In case of agricultural graduates, it can be assumed that they might already knew most of the information provided as they study in their text books. Thus, there was less for them to utilize and follow.

Table 8: Opinion of course learners about content relevance (N=42)

Variable	Category	Percentage	
		Gardeners	Agri. graduates
Content relevance	Highly relevant	100	90.00
	Somewhat relevant	NIL	10.00
Message treatment	Moderate technical words	9.09	15.00
	Less technical words	90.90	85.00
Adequacy of content	Adequate	100	100
Usefulness of content	Highly useful	100	70.00
	Moderately useful	NIL	30.00
Audio quality	Very clear	90.90	95.00
	Moderately clear	9.09	5.00

Opinion of course learners about content relevance indicates the significance of content being disseminated via MobiMOOC - a massive open online course on horticulture. For the present study, opinion about content relevance, treatment of message, adequacy and usefulness of

content and audio quality were studied and measured on a three point continuum. Treatment of message refers to the modification of the content into local language with less technical terms for better retention and understanding of learners. Adequacy of content implies to the ability of the messages to provide accurate information. Usefulness of the content implies to the worth/value of the information provided.

Table 8 reveals that opinion of farmers about content relevance of MobiMOOC - a massive open online course on horticulture was fairly good. All the gardeners (100 per cent) and 90 per cent agricultural graduates opined that content of MobiMOOC - a massive open online course on horticulture was highly relevant. All the horticultural information disseminated through MobiMOOC - a massive open online course on horticulture was in local dialect so, the information presented was found useful by the learners. Content was reported as less technical by 90.90 per cent gardeners and 85.00 per cent agricultural graduates. Moderately technical content was reported by 9.09 and 15 percent gardeners and agricultural graduates respectively. Cent per cent gardeners and agricultural graduates found the content, adequate. All the gardeners (100 per cent) and majority of agricultural graduates (70 per cent) found the content of MobiMOOC - a massive open online course on horticulture highly useful followed by 30 per cent agricultural graduates who reported the content as moderately useful.

It can be concluded from the above findings that quality information increases understandability and adoption of the information. This will be reversed if the information given contains highly technical words and irrelevant content. Therefore, before presenting any information, particularly to rural communities, it is necessary to treat or modify the message as per the local language or convenience of the target beneficiaries. As far as the adequacy and usefulness of the content are concerned, majority of the farmers tilted towards positive side. Messages which don't provide the complete information about a problem are not considered useful for the farmers. Therefore, information provided through MobiMOOC - a massive open online course on horticulture should keep disseminating crop, location and language specific agricultural information to the farmers on similar lines.

Table 9: Opinion of course learners about usability features (N=42)

Statements	Gardeners		Agri. Graduates	
	Mean value	Rank	Mean value	Rank
It is the fastest way to collect horticultural information in a shorter time.	2.47	II	2.95	I
It's a costly affair to get horticultural information	1.1	VI	1.05	VIII
Information provided through MobiMOOC - a massive open online course on horticulture was easy to understand and follow.	2.9	I	2.9	II
Audibility of the lessons was poor and words were hard to understand.	1.1	IV	1.3	VII
Quizzes were relevant and well chosen.	2.45	III	2.65	IV
Farmers and their next generations	1.1	VI	1.35	VI

should not undergo such courses.				
I would have not taken this course if there was no certificate offered for this.	1.14	V	1.6	V
I will recommend this course to others.	2.9	I	2.75	III

The data presented in Table 9 indicated that the information provided through the MobiMOOC - a massive open online course on horticulture was opined as the fastest mode of getting horticultural information, it was easy to understand and follow and they would like to recommend this course to others. Hence, most of the learners gave it high ranking with the highest mean score values (varies from 2.95 to 2.75). They opined that the quizzes were relevant and well-chosen with the second highest mean score value of 2.65 and 2.45. Mean values (varies from 1.1 to 1.6) shows that development of Indian agricultural community is possible through courses like MobiMOOC - a massive open online course on horticulture and everyone who is interested in agriculture must go for such courses in future. The results pointed out that farmer largely disagreed with the statement that MobiMOOC - a massive open online course on horticulture was a costly affair to get information with a lowest mean value of 1.1 and 1.05.

It was good to note that most of the farmers with little difference in mean score value (2.74) did not believe that lessons' audibility was poor and words were hard to understand. It means that they found it as a useful medium for farming community. Both, gardeners and agricultural students said it would be good if they get certificates after completion of the course, however, they were okay even if they don't get one (mean value 1.14 and 1.6).

Table 10: Constraints faced by the course learners (N=42)

There were factors which hampered the access of information provided through MobiMOOC - a massive open online course on horticulture and its adoption for better outputs. In this investigation the learners were asked to indicate various constraints faced by them to access and to adopt the recommendations of the course. The constraints as perceived by the course learners that affected the adoption of improved agricultural practices were identified in the present investigation. Various constraints faced by the learners (who adopted the practices recommended), farmers who discontinued after once they adopted and who did not adopt it have been analysed and discussed as follows.

Constraint	Gardeners		Agri. Graduates	
	Mean value	Rank	Mean value	Rank
Encountered technical issues while taking the lessons	2.2	I	1.90	I
Recommendations were no ready to use.	1.88	II	1.78	II
Involves too many steps to fetch information.	1.59	III	1.1	III

Out of twelve constrains, above three were found to be the major ones.

While taking the lessons almost all learners encountered some technical issues. For every step and for question and answer sessions, learners were supposed to press number keys to proceed further. But many a times mobile was not accepting the keys even if it was a right one. Learners found it even more difficult at the time of quiz sessions. Second constraint with the mean value of 1.88 and 1.78, was that fertilizer recommendations were not ready to use. Indian agriculture is diverse and changes with the place. People use different measuring units when it comes to the field conditions but the doses were recommended in standard terms. Hence, users needed to change the fertilizers or pesticides doses accordingly which is quite difficult for them. Getting information involves too many steps was ranked third (means value 1.59 and 1.1) especially within the crop.

It can be concluded that learners had already liked the service and would want to undergo many such courses in future. Resolving these small technical issues will definitely make a difference. In broader perspective the horticultural scenario in India will be improved unquestionably.

Table 11: STUDENT SURVEY - TEXT-BASED RESPONSE

<i>QUESTION</i>	<i>RESPONSE</i>
<i>What did you particularly like about this short course?</i>	<ul style="list-style-type: none"> • Course content, relevance of topics and especially its mode of delivering the lessons over mobile phones • Course audio format, complete information in a very short time and quiz system • Convenience of the mobile course format and the flexibility to take the lessons at their most convenient time • Cost effective, saves time, all horticultural information is now available at our fingertips.
<i>What did you not like about the course?</i>	<ul style="list-style-type: none"> • Messages were speedy hence we found it difficult to note down important recommendations. • Key press issue while taking the lessons.
<i>What other short courses would you be interested in for future?</i>	<ul style="list-style-type: none"> • Short courses on: entomology, pathology, field crops, food preservation, forestry, soil testing, bio-fertilizer, organic farming, mushroom cultivation, • Diversified agriculture: poultry keeping, fish farming, • More agricultural/horticultural crops should be covered • Information on storage should also be included • Entrepreneurship: small business development in rural settings • Developmental programmes for the farmers. • Educational topics: instructional design,

What suggestions do you have on how we can improve this short course, in its content, delivery or administration?

applications of mobile technologies for agricultural development

- Audio: Higher quality and bit slow audio sequences. The ability to more easily listen to and note down the important recommendations. More uniform audio quality throughout – some were fast.
- Practicality: More use of applied topics like soil testing and storage, and trade names of pesticides were requested by some learners.
- Assessment: More quizzes, perhaps at the end of each topic segments. The ability to re-do quizzes to achieve mastery. More variety in the style of online quizzes
- Topic summaries provided on a weekly basis
- Technical issues should be resolved once and for all for future courses.

The open-ended responses indicated strong support for the MobiMOOC - a massive open online course on horticulture. The responses also provided an opportunity for learners to highlight areas for improvement in subsequent iterations of the course. The feedback was both positive and constructive, and should be incorporated into future course designs.

SECTION – C

RESULTS FROM NON-PARTICIPANTS AND DROP OUTS

Non-Participants

A group of ten people of similar socio-economic and geographical conditions were selected as a control group for the investigation. They were never the part of MobiMOOC - a massive open online course on horticulture, thus never attended any of the lessons. A set of general questions were picked up from the course quiz to compare their knowledge level with those who successfully completed the MobiMOOC - a massive open online course on horticulture.

A score of one for each correct answer was assigned to respondents. The results of knowledge test on non-participants shows that they could hardly give the exact answers. They had the basic knowledge of practicing horticulture but were not up to date with their knowledge nor did they know about the latest practices in horticulture. While those who successfully completed the course were much ahead of them especially in terms of latest varietal information, soil testing, seed treatment and pest control practices in horticultural crops. Thus, it is clear that MobiMOOC - a massive open online course on horticulture has made a significant difference in the lives of its users.

Drop outs

- A sample of fifteen drop outs were selected randomly for interview but finally eleven could be contacted. Majority of the drop outs were the intermediate school students. It is important to note here that negligible percentage of gardeners and agricultural graduates dropped the course in between. Thus, it can be concluded that farmers and agricultural graduates are the suitable target beneficiaries for such courses.
- The other reason could be the availability and ownership of mobile phones with the school students. This reasoning could be supported by the fact that when the researcher tried to cross check the mobile numbers of school students given at the time of registration, either the number was not in use or in some cases phone was picked up by an unknown person.
- Two drop out graduates from other locations reported that they were overburdened with their routine examinations at college thus, could not complete the course and dropped in between. However, they also agreed that the course was very useful and given an opportunity, they would like to take this course again.

SECTION - D

FEEDBACK FROM THE COURSE DEVELOPMENT TEAM

A questionnaire was sent via electronic mail to eleven members of the MobiMOOC - a massive open online course on horticulture development team in February 2015, around one and a half months after the conclusion of the course. The questionnaire asked team members to consider the course from a design perspective, and in particular from their roles as team members and what constraints have they faced while designing, developing and implementation of the course.

Ten team members out of eleven returned their responses to seven questions that included open-ended text-based response questions. The responses are provided in the here. A discussion over all the responses will be detailed separately.

Table 12: QUESTION 1

<i>QUESTION</i>	<i>RESPONSE</i>
<i>Describe your role in the MobiMOOC - a massive open online course on horticulture.</i>	<ul style="list-style-type: none"> • 1. Instructor (course design, content creation and audio recording) 2. Management and coordination and 3. Technology expert for MobiMOOC - a massive open online course on horticulture platforms • Involved in each phase of promotion, reviewing, conceptualizing, designing, development, recording, delivery and maintenance. • As an instructor, I helped in the development of the course by creating HTML and audio content of 22 horticultural crops of worth 2 hours and 13 seconds duration. I was also involved in promotional activity to popularize the concept of mobile learning in horticulture. This kind of

initiation attracted a huge mass of learners to the course. I was also involved in editing the voice content before final hosting and airing. Developed question set for the examination which was delivered to the registered users every weekend.

- I was mainly responsible for developing the platform on which the course was hosted and through which the lessons were delivered. I was also involved in the development of analytics and gradebook modules for the course. I also managed the technical platform, content release process.

Each of the participants who responded indicated a clear understanding of her/his role within the MobiMOOC - a massive open online course on horticulture team.

Experienced educators with a background in open and distance learning (ODL) might be expected to understand the differentiated staffing models typical of ODL institutions and programs (Porter, 2014). In the case of the M4D course, the experience of the individual team members was revealed through the clarity with which each of those professionals specified her/his role within the team in the questionnaire responses. They knew their roles and executed them within the course framework.

As a general recommendation, the selection of participants for MOOC design, development or delivery processes would benefit from having individuals with significant ODL experience as a part of the team. MOOCs are complex educational projects requiring defined instructional development and delivery skill sets. In this case where there were minimal opportunities to have a physical contact with the target users, the course team could design, develop and executed the whole course very successfully.

Table 13: QUESTION 2

<i>QUESTION</i>	<i>RESPONSE</i>
<p>What were your personal goals associated with participation in the design, development and/or delivery of the <i>MobiMOOC - a massive open online course on horticulture</i>? That is, what did you hope or expect to achieve through your participation in this course?</p>	<ul style="list-style-type: none"> • I wanted to learn about a system that can overcome the time and space lag and make the information open to the whole world where almost everyone who is willing, could acquire the knowledge. • Wanted to share my knowledge in the domain and learn about how to 'run a MOOC' - end to end. Also wanted to explore platforms for delivering a MOOC. • Share my knowledge of agriculture and mobile learning and participate in an m-learning dialogue; guide learners; support the m-learning community • Other random interests: 1. Knowledge dissemination. 2. Gain more experience with new delivery model (i.e. MOOC) for knowledge dissemination. 3. Gain self confidence in handling

such innovative assignments 4. Generating pieces of new knowledge that can help the farming community as a whole.

- My goal was to ensure that the instructors' platform meet all the requirements and to make tracking and analysing, simple and more accurate.
- I believe that learning materials should be made available and affordable to people in developing countries. I also wanted that only the most important and needed information to go to the target audience in a shortest possible time.
- I was interested in broadening and also updating my knowledge in the space of MobiMOOC - a massive open online course on horticulture by learning from other instructors and literature. I was also interested in gaining practical experience of managing a MOOC platform, understanding issues in running a MOOC like generating good quality content, recording only the best audio lessons and preparing only the best database etc.

The statements of the development team were highly harmonious with the goals of the course itself. Not only did team members express a strong desire to provide accessible learning at low cost, they also expressed a willingness to both learn and share knowledge, and to become co-learners with other instructors and learners. In particular, team members expressed a desire to learn more about MOOCs as a delivery format and as a pedagogical practice, and through the course contribute new knowledge.

Building on Vroom's (1964) expectancy–valence theory of motivation, Porter and Lawler (1968) proposed a model of intrinsic and extrinsic work motivation. Intrinsic motivation involves people doing an activity because they find it interesting and derive spontaneous satisfaction from the activity itself. Extrinsic motivation, in contrast, requires an instrumentality between the activity and some separable consequences such as tangible or verbal rewards, so satisfaction comes not from the activity itself but rather from the extrinsic consequences to which the activity leads. In the specific case of MobiMOOC - a massive open online course on horticulture, it can be said that, first, the development team worked hard as it was a part of their job and they were paid money for the task. Secondly and more importantly, they worked even harder and made the course a very successful event because they found it interesting and challenging hence, derived extemporaneous gratification when they successfully completed it. Studies also showed that optimally challenging activities were highly intrinsically motivating (e.g., Danner & Lonky, 1981) and that positive feedback (Deci, 1971) facilitated intrinsic motivation by promoting a sense of competence when people felt responsible for their successful performance (Fisher, 1978; Ryan, 1982).

Table 14: QUESTION 3

<i>QUESTION</i>	<i>RESPONSE</i>
As a course designer, what was your most crucial part during the development and implementation of <i>MobiMOOC - a massive open online course on horticulture?</i> Please explain in detail.	<ul style="list-style-type: none">• My chief concern was the receptivity to this mode of learning. Since it was novel and so to say until then not been tried on the actual learners and field conditions. The appropriate design of the course content in the form of short audio lessons was also a challenge laden task.• Knowledge assimilation in that manner was quite unusual to Indian context, hence to be rigorously tested in the light of the feedback from participants.• In my opinion keeping the crop information very brief yet complete was the major challenge as agriculture is a vast subject and has huge variation. Therefore, content creation was one of the most crucial part.• Since, this was a novel attempt and has never been tried and tested before therefore very few reviews were available to take ideas for developing a suitable technology. Platforms were developed on trial and error basis, but above all our expectation it worked amazingly well.

As most of the development team members reported that the experiment was novel and not been tried anywhere else. Thus, they found it difficult to develop such a system which could have a database of all the users, lessons and a delivery platform that can disseminate a chosen lesson in a fraction of a second. On the other hand, developing content on a specific crop right from seed sowing till harvesting that gives a complete information in few minutes was also a herculean task. Yet, experiments after experiments and pilot testing in two phases gave confidence to the team members to replicate it on a larger scale.

Table 15: QUESTION 4

<i>QUESTION</i>	<i>RESPONSE</i>
Please comment on the attributes of the technical platform used to deliver the <i>MobiMOOC - a massive open online course on horticulture.</i>	<ul style="list-style-type: none">• Primarily we wanted to have two platforms: 1. For creating a user and content database and 2. For dissemination of content. Technology platform that we chose supported the above two threads (it had ample room for creating a detailed user database and hosting all the content that was prepared for the <i>MobiMOOC - a massive open online course on horticulture.</i> This also has space to handle a bigger database for users and content just in case. Other area where choice of

technology platform was important was content creation. Chosen tools allowed us to record/edit/host audio lesson in a flexible manner.

- The platform was combination of the mobile handset, a Primary Rate Interface (PRI) connection from the service provider as well as a computing server in the background to record and process the data. This enabled the participants to enjoy the benefit of online delivery without restrictions of time and place. This also facilitated the development team in compiling the results and its eventual communication to the candidates.
- The delivery mechanism allowed for the dissemination of the information was simple for the novice to use. Fetching information was in this course, there was technical help for those with access problems. Learners could easily contact the instructors and development team.
- The system requires no internet for users to fetch the information. Only the expert needs internet connection to update, upload and monitor the course. It had no time and space barrier as the user can take the lesson at his most convenient time. It was possible to monitor the drop outs from the system itself.

As indicated by team responses, the Drupal platform worked well for the design and delivery of the MobiMOOC - a massive open online course on horticulture and supported the primary needs of such course viz designing the course content and its dissemination port of discussions.

Table 16: QUESTION 5

<i>QUESTION</i>	<i>RESPONSE</i>
Please comment about how well you believe the <i>MobiMOOC - a massive open online course on horticulture</i> design supported the desired learning outcomes that the course was intended to deliver?	<ul style="list-style-type: none"> • Course participants, expectedly, had large variation in background and course access environment. Despite this diversity, the examination that happened over phone at every weekend showed that the intended learning outcomes were achieved to a great extent. Users understood the lessons correctly and implemented few recommendations they got through the course. • A word of mouth feedback was also taken from the participants during their visit to IIT-Kanpur campus to collect their certificate of completion. Users had appreciated the design and content of

the course.

- The course was designed to increase users' knowledge about the horticultural course. By looking at their participation and good performance in the examination, I believe that the course did a great job in empowering participants with little or no technical and educational background.

Answering to the examination questions (either through peer groups or through their written notes) might have greatly helped the users in scoring high. More quizzes, especially in the middle or immediately after each lecture would be a better idea to check their knowledge retention.

Informal feedbacks are good sometime to make the user feel at ease and respond more freely. This could have been more elaborative and objective by having a similar IVR system as a part of every week's lesson. This would have helped the development team to understand any lacunae to work upon and make next week's lessons much better.

Table 17: QUESTION 6

<i>QUESTION</i>	<i>RESPONSE</i>
Please comment on what you believe might be desirable attributes that learners should possess to be successful in a course such as <i>MobiMOOC - a massive open online course on horticulture?</i>	<ul style="list-style-type: none">• Should be comfortable and enthusiastic about virtual engagement. 2. Should have at least a mobile phone and basic operating skills.• Wanting to learn rather than a certificate (we had a few like that). Commitment to participation and completion of the entire course or all the elements of the course that are relevant to them, which might be achieved by customizing the learning path for individuals in the course.

Desirable attributes for learners in a course such as *MobiMOOC - a massive open online course on horticulture* included basic skills of operating a mobile phone and getting the horticultural information. Each team members described somewhat similar attributes.

Table 18: QUESTION 7

<i>QUESTION</i>	<i>RESPONSE</i>
Please enlist the constraints faced by you while developing and implementing the <i>MobiMOOC - a massive open online course on horticulture.</i>	<ul style="list-style-type: none">• Evangelization: The initial promotion of the concept through personal contact by visiting a number of schools and colleges was a formidable challenge, which was later overcome by a massive promotional efforts, resulting in a large number of admissions.• Delivery platform being unconventional, we had to

be in consistent touch with the candidates and push them harder to complete the course.

- Users had to self-register themselves to the course by giving their details over the mobile phone to the IVR system. In most of the cases their voices and words were not clear enough. Hence, we had difficulty in recording their correct information.
- Making a lesson very short yet complete to sustain the interest of the user was another major challenge.

Although this was the first attempt to run this kind of virtual course to help the agricultural academia and farming community about horticulture, but the team could design, develop and implement the course successfully. While MobiMOOC - a massive open online course on horticulture team could address some of the issues, a few more needs to be done to take full advantage of this effort.

7. Human interest stories

To support the results from the personal interviews, few human interest stories from practicing gardeners and agricultural students were also captured, video recorded and shared in this section.

Box 1: Mr. Bhale Narayan Pandey: Reaping the Benefits of MobiMOOC - a massive open online course on horticulture

Mr. Bhale Narayan Pandey, age 37 years, a practicing gardener with nursery unit of Indian Institute of Technology, Kanpur region of Uttar Pradesh is educated up to tenth standard. He is very well known and respected figure in the gardeners' community of the campus and has played a key role in motivating fellow gardeners to register for the MobiMOOC - a massive open online course on horticulture. According to other respondents, Mr Bhale Narayan Pandey was the major source of their information for this course and they registered for the course on his recommendations. Although he was experienced in his gardening job, he was still unaware about the hybrid varieties, seed treatment and latest pest control practices of the fruit crops. He is reaping the benefits from the information got from the MobiMOOC - a massive open online course on horticulture.

In a specific case of frequent attack of stem borer (an insect that attacks the stems of the crop) in mango trees grown in his nursery. The stem borer used to grub tunnels in the sapwood on the trunk or branches and makes irregular tunnels that results in wilting of branches or entire tree (http://agritech.tnau.ac.in/crop_protection/mango/mango_1.html). After trying many remedies he was not able to control the damage. Through the MobiMOOC - a massive open online course on horticulture, he got to know its management with kerosene oil. He tried this recommendation which helped him out in getting rid of the attack, thus, he could save the mango trees by following the recommendation of MobiMOOC - a massive open online course on horticulture. Mr Pandey feels, this course beneficial for gardeners like him. (Video shared at

https://drive.google.com/folderview?id=0B74PuzmCduv_UTJxWHRGNEJvLTA&usp=sharing)

Box 2: MobiMOOC - a massive open online course on horticulture: demonstrating role in formal education system

MOOCs not only helped the gardeners in finding solution to their field problems but also helping in agricultural graduates in preparing for competitive exams. Ms Niharika Verma, 21 years old, final year student of B.Sc Horticulture, CSAUA&T, Kanpur, is the only female respondent of this investigation. She made use of MobiMOOC - a massive open online course on horticulture in an innovative way. While taking the lessons, she simultaneously made notes of lessons and quizzes for all the crops. At the end of the MOOCs course she had a good volume of brief and complete notes of 22 horticultural crops. As the information provided through MobiMOOC - a massive open online course on horticulture was crisp and complete thus, she is using these notes for the last minute preparation of competitive examinations for higher studies.

Ms Niharika feels that she tends to remember more what she hears through the MOOC course over her mobile than what she reads in the text books. Here we see two course learners of the same course but completely different and interesting use of information provided through the MobiMOOC - a massive open online course on horticulture. While the gardener making a practical use in the agricultural field the student using it for educational competence. She showed her interest in taking up many more such courses in future. The video is available at

https://drive.google.com/folderview?id=0B74PuzmCduv_UTJxWHRGNEJvLTA&usp=sharing)

8. Summary, limitations, Implications and Recommendations

Overall results showed that selected course learners exhibited a positive sign of accepting the information and communication tools for steady agricultural information. They used and shared the information of MobiMOOC - a massive open online course on horticulture, its services and recommendations with large number of people. They opined that development of Indian farmers is possible through such initiatives and they also want other fellow learners and their next generations to make use of these techniques for better agricultural practices and outcomes. Where a large majority of Indian farming community is illiterate, the technique used to disseminate horticultural information in this course cuts across the issue of illiteracy thereby increased the adoption by serving farmers at their doorstep. So, most of the farmers appreciated the innovation which gives them free and most convenient access to better information.

The course development team also conducted the MobiMOOC - a massive open online course on horticulture with a view to better understanding the dynamics surrounding the design, delivery and support issues in delivering MOOC-style courses in the field of agriculture.

Limitations

Limitations of the study are as follows:

- The study was conducted in selected district of Uttar Pradesh state on selected gardeners and agricultural students. Therefore, the findings cannot be generalized for small and marginal farmers and agricultural students of other locations of the State.

However, these can be considered for farmers and students with infrastructure similar to locations selected for the study.

- Since, findings of the study are based on expressed responses of the respondents; the objectivity of study was limited to the frankness and fairness of respondents in furnishing the information.
- The study was conducted in geographically tough locations with minimum transportation available, so reaching to each and every farmer to personally interview them was a very challenging job for the researcher.
- The study also had limitation of time resource faced by the single investigator.

Implications

- MOOCs capacity needs to be strengthened in terms of benefits, availability and ease of access to MOOCs resources to every farmer as well as academia.
- Most of the farmers and students are not fully informed about the existing services and various facilities of MOOCs, creating awareness among agricultural community regarding the range of services available may help the course development team to increase its impact in long run.
- MOOCs offer significant advantages over complicated text messaging and general agro-advisory services in terms of cost effectiveness, convenience and content flexibility. Wherever literacy is a concern MOOCs for mobile is an answer.
- Most of the farmers interviewed, were prepared to pay for information services that MOOCs on mobile offer as long as it continues to give them relevant and updated agricultural information in a timely and reliable manner.

In the spirit of the MobiMOOC - a massive open online course on horticulture team's general goals and in the light of course learners' feedback the following recommendations are proposed:

Recommendation 1

Consider the primary outcomes for the course in the re-design process and whether the aim of the course is knowledge transmission (what learners will know), competence (what learners should be able to do), or a broader goal such as learner empowerment (the ability to learn on one's own from multiple sources). Be explicit about designing for the primary outcome/s (Guardia, Maina & Sangra, 2013).

Recommendation 2

Use additional quizzes at the conclusion of each topic/lesson in MobiMOOC - a massive open online course on horticulture. The quizzes would provide ongoing feedback for learners and potentially offer an incentive for them to continue their participation towards a certificate (Porter, 2014).

Recommendation 3

An IVR based instant feedback system should be planned at the end of each lesson for an instant feedback of the content relevance and delivery quality. This would help the course development team to respond dynamically and address lacunae if any

Recommendation 4

Consider a course pre-test or learners to help gauge the relative achievement of learners entering the course with different levels of knowledge, measured against their acquired knowledge.

Recommendation 5

Plan, re-design, and implement additional iterations of the MobiMOOC - a massive open online course on horticulture, incorporating improvements suggested by learners and development team members. Evaluate and report the findings with a view to optimizing the course and defining a generalized set of design principles for courses of this type and intended audience.

Recommendation 6

A cost-benefit analysis and a SWOT analysis could to also be planned to monitor course development, delivery, evaluation costs and future opportunities to further scale up this course. Using a consistent schema, such as the one outlined in Bennett Hierarchy model of planning and evaluation (1976) to evaluate such courses, would provide a benchmark for further planning and development.

Recommendation 7

There is a famous saying of Pt Jawahar Lal Nehru that “In order to awaken the people it is the women, who have to be awakened. Once she is on the move, the family moves, the village moves and the country moves forward.” In the specific case of MobiMOOC - a massive open online course on horticulture it is strongly recommended to increase the women participation to make the course most successful.

9. PHOTO AND VIDEO DOCUMENTATION FROM FILED

Photo and video documentation from the filed can be viewed on:

1. https://drive.google.com/folderview?id=0B74PuzmCduv_UTJxWHRGNEJvLTA&usp=sharing
2. https://drive.google.com/folderview?id=0B74PuzmCduv_Nlc1akxVaXRiMHc&usp=sharing

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-

Annexure I

MobiMOOC - a massive open online course on horticulture – at a glance

MobiMOOC - a massive open online course on horticulture is a novel attempt to rejuvenate and transform the way of cultivation in India. It has been accomplished entirely on mobile technology using simple mobile phones. It is an initiative of IIT-Kanpur for educating people of India using mobile phone technology. This is an experimental technology based on Interactive Voice Response (IVR) and Open Source Soft Switch PBX system to disseminate audio lessons.

The course is about set of farming practices being communicated in a voice recorded format. Popularly known as voice-Package of Practices, these practices cover all aspects of cultivation from sowing up to harvesting. An IVRS (Interactive Voice Response System) is used to guide the candidates in a step by step manner and thus navigate the program components without any let or hindrance.

Who should attend this course?

This course is conducted by agricultural experts for the agricultural community (farmers/agricultural students) of India.

Course contents and topics

The course content encompasses 22 vegetable, fruits and flower crops. It also gives a detailed guide to the general practices for maintenance of the crops. The content of the course has been taken from the book "*Krishi Gyan Manjusha*", published by the Department of agriculture, Uttar Pradesh, India. At the end of the course, a participant should be able to know the cultivation practices that should be followed for major horticultural crops in Uttar Pradesh, India.

Certificates

The students were given Course Completion Certificate. The course completion includes 50 per cent of listening to the course and scoring 50 per cent in the quiz conducted.

Interview Schedule
Part I

S.No.

Date.....

Study Title: "MobiMOOC - a massive open online course on horticulture - an effectiveness study, Uttar Pradesh State, INDIA"

Group/Location:.....

1. **Name** :
2. **Gender** : M/F
3. **Age (in years)** :
4. **Occupation** : Student/Farmer
5. **Education** :

S. No.	Category	
1.	Illiterate	
2.	Primary level	
3.	Middle level	
4.	High school level	
5.	Intermediate	
6.	Graduate and above	

PART II

Below are the questions formulated to assess the effectiveness of MobiMOOC - a massive open online course on horticulture on learners and practicing gardeners. The schedule is divided into two major halves: first part consists of general information about accessing the course and constraints faced by them. The second part consists knowledge test, extent of adoption of the practices recommended through the course and opinion of farmers as a result of joining the MobiMOOC - a massive open online course on horticulture.

A. General awareness

1. **How did you come to know about the MobiMOOC - a massive open online course on horticulture? Please indicate by (v) mark.**

S. No.	Sources of awareness	(v)
1.	IIT-Kanpur scientists	
2.	Friends/Relatives	
3.	School/College Notice boards	
4.	Internet	
5.	Promotional messages over mobile	

Note: Multiple responses are allowed

2. Information sharing behavior of the users of MobiMOOC - a massive open online course on horticulture

a. Please indicate by (v) mark whether you shared the information gathered through MobiMOOC - a massive open online course on horticulture or not? If yes, with how many?

S. No.	Category	(v)	Number of persons shared	(v)
1.	Shared		Less than five	
2.	Not shared		Six to ten	
3.			More than ten	

b. Please indicate by (v) mark the nature of persons shared about the MobiMOOC - a massive open online course on horticulture?

S. No.	Nature of persons	(v)
1.	Family members	
2.	Friends	
3.	Relatives	
4.	Fellow farmers	
5.	Neighbors	

3. Gratification of services of MobiMOOC - a massive open online course on horticulture?

Please indicate by (v) mark whether you are satisfied with the services of the **MobiMOOC - a massive open online course on horticulture?**

S. No.	Category	(v)
A. Results of recommended practices		
1.	Satisfied	
2.	Not satisfied	
B. Utilization of the knowledge gained		
1.	Utilized to fullest extent	
2.	Utilized to medium extent	
3.	Not utilized	

4. Constraints faced by the users of MobiMOOC - a massive open online course on horticulture

Please, rate the constraints faced by you while accessing the MobiMOOC - a massive open online course on horticulture on three point continuum (where 3= Always, 2= Sometime and 1= Never)

S. No.	Constraint	Always	Sometimes	Never
1.	Toll free number never gets connected			
2.	Involves high technical skills to fetch information			
3.	Less number of trainings on access of MobiMOOC - a massive open online course on horticulture lessons			
4.	Lack of experienced trainers			
5.	Content was not crop and language specific for UP region			
6.	Involves too many steps to get information			
7.	Difficulty in following as per the lesson's recommendations			
8.	Content was not up to date			
9.	Lack of technical support from the course team			
10.	No response to the queries of learners in case of inaccessibility of the lessons			
11.	Recommendations were not ready to use			
12.	Any other (please specify)			

4. Opinion of farmers about content of MobiMOOC - a massive open online course on horticulture

Please indicated your opinion by (v) mark the chosen options on following headings:

1. Opinion about content relevance

S. No	Variable	Particulars
1.	Content relevance	a) Highly relevant b) Somewhat relevant c) Irrelevant
2.	Treatment of the message	a) High technical words b) Moderate technical words c) Less technical words
3.	Adequacy of the content	a) Adequate b) Somewhat adequate c) Inadequate
4.	Usefulness of the content	a) Highly useful b) Moderately useful c) Not useful

2. Opinion of users about usability features of MobiMOOC - a massive open online course on horticulture:

Below is a list of statements about the extent to which you apply MobiMOOC - a massive open online course on horticulture in farming. Please choose one description that best describes your situation on three point continuum (Agree=3, Partially agree=2, Disagree=1).

S.No.	Statements	Agree	Partially agree	Disagree
1.	It is a rich source to collect updated information on horticulture.			
2.	It is the fastest way to exchange agricultural information in shorter time			
3.	It is a costly affair for the farmers.			
4.	Using MOOC course is nothing but a time pass.			
5.	Information provided through MobiMOOC - a massive open online course on horticulture was easy to understand			
6.	Audibility of the lessons was poor and words were hard to understand			
7.	Questions in the quizzes were relevant and well chosen.			
8.	Farmers and their next generations should not undergo such courses.			
9.	I would have not taken this course if there were no certificate offered.			
10.	I will recommend this course to others.			

16. Additional information

a. What did you particularly like about this course?

.....

b. What did you not like about this course?

.....

c. What other such courses would you be interested in for the future?

.....

d. Please suggest as how the course team can improve this course in its content, delivery or administration?

.....

Annexure III

INPUTS USED FOR THE COURSE (To be filled by the researcher)

1. Human resource involved (secondary sources)

a.	Human resources involved	
i.	Number of agricultural scientists	
ii.	a. Number of course designers from Indian Institutes of Technology, Kanpur b. Others, if any	
iii.	Number of other technical personnel involved	
iv.	Number of language experts involved	
v.	Total number of registered learners a. Male b. Female Total number of active learners a. Male b. Female Total number of successful learners a. Male b. Female Total number of farmers enrolled Total number of active farmers Total number of successful farmers	
Total		

2. Inputs used for MobiMOOC - a massive open online course on horticulture: (secondary sources)

Financial and human resources involved in the programme

	Items	Rs./Number
a.	Financial resources spent**	
i.	Money spent for conducting trainings	
ii.	Advertisements for popularization of MobiMOOC - a massive open online course on horticulture	
iii.	Transport charges	
iv.	Money spent on calls	
v.	Publications	
Total		

****Excluding time value of human resources**

3. Activities of key stakeholders of the MOOCs on Horticulture course and products developed:

S. No.	Key stakeholder	Activities	Products developed
I.	Agricultural scientists		
II.	Technical persons a) Course designers		
III.	Recording Team		
IV.	Other technical persons (audio and language editors)		

Annexure IV

Feedback from the course designers of MobiMOOC - a massive open online course on horticulture

Name:

Designation:

Q.1. What was your role in the MobiMOOC - a massive open online course on horticulture design, development or delivery processes?

.....
.....
.....
.....
.....

Q. 2. What were your personal goals associated with participation in the design, development and/or delivery of the MobiMOOC - a massive open online course on horticulture? That is, what did you hope or expect to achieve through your participation in this course?

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.....

Q. 3. As a course designer, what was the most crucial part during the development and implementation of MobiMOOC - a massive open online course on horticulture? Please explain in detail.

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Q. 4. Please comment on the attributes of the technical platform used to deliver the MobiMOOC - a massive open online course on horticulture.

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Q. 5. Please comment about how well you believe the MobiMOOC - a massive open online course on horticulture design supported the desired learning outcomes that the course was intended to deliver.

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Q. 6. Please comment on what you believe might be desirable attributes that learners should possess to be successful in a course such as the MobiMOOC - a massive open online course on horticulture.

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Q. 7. What enlist the constraints faced by you while developing and implementing the MobiMOOC - a massive open online course on horticulture?

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Thank you for your valuable time in completing this survey.
