A Study on the Development of a MOOC Design Model

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The purpose of this study was to develop a MOOC design model that would improve the current practice of MOOC development in Korea by specifying easy-to-use course development procedures and guiding strategies. Following Richey and Klein (2007)’s conceptual model development procedure, the first step was to perform critical review of relevant literature and observe typical MOOC development processes. As a result, the initial model was developed. The second step was to conduct the expert review with five educational technology and MOOC researchers to secure the internal validity of the model. Based on the experts’ suggestions, the model was revised and once again reviewed by the same experts. This process resulted in the development of the 2nd version of model. The third step was to carry out external validation research in order to test the effectiveness, efficiency, and usability of the model. A basic model may be confirmed or corrected based on examination of its results. Consequently, the model was elaborated as the final model. In the final model, 6 procedural phases and 9 specific steps were included. The six procedural phases are: Analysis (1st Iteration), Design, Development (Course Development), Implementation, Evaluation, and Analysis (2nd Iteration), a slight variation of ADDIE model. The specific steps include: 1) Goal Setting, 2) Environment Analysis, 3) Content Design, 4) Style Design, 5) Course Development, 6) Implementation Plan, 7) Course Implementation, 8) Summative Evaluation, and 9) Need Reflection. The study concluded with suggestions for further research and application of the MOOC design model.

Keywords: MOOCs, MOOC design model, online learning

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Introduction

MOOC is leading the online education world and expanding rapidly. After the emergence of representative MOOC sites such as Coursera and edX, many other MOOC sites are appearing not only in North America, but also in Europe and Asia.

These diverse countries pay their attention to MOOC for surviving in order to survive in the higher education market. They want to hold a higher educational hegemony (Rha et al, 2015). For these reasons a lot of MOOCs are provided through various platforms. But practice has a long lead on research. The competitive environment increased the number of MOOC sites but the obscure pedagogical meaning of MOOC courses were pointed as a limitation and the quality couldn't be guaranteed in absence of systematic research.

MOOC design principles and development processes have been studied by many researchers (Lim, & Kim, 2014; Lim, Kim, Kim, Han, & Seo, 2014; Guàrdia, Maina, & Sangrà, 2013; Scagnoli, 2012; Vladimir, 2012). Most MOOC research is conducted along with the existing e-learning developmental study by ADDIE model (Jung, 1997; Jo, 2002; Alonso et al, 2005; Driscoll, 2002; Lee & Owen, 2000). Some previous research suggested MOOC principles considering characteristics of MOOC by different teaching and learning method. However, there are few specific explanations on what phase and which principle should be considered when designing the courses. In other words, it was difficult to find research that suggested a design model as a procedure considering practicality and prescription to give guidance to instructional designers and instructors when designing MOOC.

Thus, it is essential to construct the MOOC design model so that it can give specific guidance on design activities while considering the characteristics of MOOC. This study was conducted to develop a model, which can be used when designing MOOC, as an attempt to satisfy practical and theoretical requirements of the MOOC design model. Therefore, this research aims to identify components of
the MOOC design and develop the design model including procedures and activities of course development. To achieve such research objectives, research topics were set as follows.

(1) What is the MOOC design model reflecting MOOC characteristics?
   (1-1) What is a conceptual model of the MOOC design reflecting MOOC characteristics (conceptual relation among MOOC design components)?
   (1-2) What is a procedural model of the MOOC design reflecting MOOC characteristics?
   (1-3) Are conceptual and procedural models of the MOOC design varied?
(2) Does the MOOC design model reflecting MOOC characteristics have a positive effect on satisfaction of instructor and learner?
   (2-1) Does the MOOC design model reflecting MOOC characteristics have a positive effect on satisfaction of an instructor?
   (2-2) Does the MOOC design model reflecting MOOC characteristics have a positive effect on satisfaction of a learner?

In this study, users of the developed MOOC design model include every person who participates in MOOC design and implementation such as instructional designers and instructors. Also, the developed model is hypothesized as the one for design and implementation of an independent individual course.

**Theoretical Background**

**MOOC**

Massive Open Online Courses, also known as MOOC is a free online course offered by the top universities and colleges in a wide range of subjects. MOOC
started from an experiment of Stanford University in which Sebastian Thrun and Peter Norvig offered their “Introduction to Artificial Intelligence” course online to anyone, for free. Over 160,000 students in more than 190 countries enrolled and not much later, Udacity was born. That started the emergence of MOOC providers like Coursera, edX, etc. edX offers over 650 courses from 93 institutions and Coursera provides 1,800 courses, partnering with 138 universities and organizations as of February 2016.

In the world, there are a lot of people who are non-English speakers, wants to participate in. Therefore, non-English speaking countries such as French, Spanish, and Chinese-speaking countries try to set up their own MOOC services that serve their own language and cultural spheres. Europe MOOC is run by FutureLearn, Miriada X etc., which are based on distant teaching university. In particular, Miriada X is the third biggest MOOC site in the world and the first in Europe. Miriada X offers Spanish service and not English. By doing so, Miriada X has the largest student group in Latin America.

MOOC is developed at a country level in Asia, unlike in Europe. MOOC development is led by the government particularly in Singapore, Thailand, Philippine and Malaysia. MOOC in these countries were developed domestically at a country level to improve the educational standards and domestic supply of qualitative education through cooperation and consolidation (Rha et al, 2015). The Japan Open Online Education Promotion Council is an organization that was formed in 2013 with the cooperation of Japanese universities and businesses. It aims to spread and magnify Japanese MOOCs throughout the country. gacco, OpenLearningJapan, and OUJ MOOC are JMOOC’s official platforms. JMOOC is the internet portal that utilizes these multiple platform1). K-MOOC also started in October 2015 at a government level. K-MOOC offered 27 courses from ten major universities in Korea last year, and continues to expand the course options to over 500 by 2018.

1) http://www.jmooc.jp/en/about/
MOOC is a new education type not led by some MOOC providers such as edX, Coursera but expanding at a country level. MOOC continues to grow, and the quality of MOOC is worthy of attention. But MOOC is far behind the curve in providing quality of design, accountable instructional delivery, or sufficient resources to help the vast majority of students achieve the intended learning outcomes of the course (Legon, 2013). It seems that systematic approach to design and development of MOOC is needed with quantitative expansions and quality management.

Characteristics of MOOC design model

E-learning instructional design development model

Before examining precedent domestic and foreign studies on the MOOC design model, since MOOC is an educational type based on distance education, online education and Open Educational Resources (OER) movements, this study analyzed phases of e-learning instructional design development model based on ADDIE activities.

Jung’s NBISD model (1997) segmented the analytic steps into needs analysis, content analysis, technological and environmental analysis. It suggested design steps as content design, interaction design and standard design. Based on its adaptation, Samsung N-ISD model suggested more specific design steps including learning structure design, storyboard design, interface design, evaluation design and implementation design. Likewise, KT-WBISD model and e-learning contents design model by Lee (2002) showed detailed design steps by adding multimedia, storyboard and flowchart designs. Sequential approach to e-learning contents development by Kang et al. (2007) suggested planning and development steps at an analytic phase in a specific manner. Driscoll (2002) mentioned about selection of a technological type used for e-learning from an analytic step. Lee & Owens (2002), Alonso et al. (2005) showed an e-learning design model conforming to ADDIE
activities. Table 1 shows comparison of activities by step of the e-learning instructional design development model.

<table>
<thead>
<tr>
<th>Country</th>
<th>MOOC site</th>
<th>Launching</th>
<th>founders</th>
<th>Language</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td>Coursera</td>
<td>2012. 4</td>
<td>Andrew Ng, Daphne Koller</td>
<td>English</td>
</tr>
<tr>
<td></td>
<td>EdX</td>
<td>2012. 5</td>
<td>Harvard and MIT</td>
<td>English</td>
</tr>
<tr>
<td>UK</td>
<td>FutureLearn</td>
<td>2012. 12</td>
<td>The open university in milton keynes</td>
<td>English</td>
</tr>
<tr>
<td>Spain</td>
<td>Miríada X</td>
<td>2013.10</td>
<td>Telefónica digital education Universia</td>
<td>Spanish / Portuguese</td>
</tr>
<tr>
<td>Japan</td>
<td>Gacco</td>
<td>2014.04</td>
<td>NTT knowledge square</td>
<td>English / Japanese</td>
</tr>
<tr>
<td></td>
<td>Open Learning Japan</td>
<td>2014.04</td>
<td>Net learning</td>
<td>English / Japanese</td>
</tr>
<tr>
<td></td>
<td>OUJ MOOC</td>
<td>2014.10</td>
<td>Open University of Japan</td>
<td>English / Japanese</td>
</tr>
</tbody>
</table>

**MOOC design element & model**

Precedent studies on MOOC design elements and developmental procedures can be summarized into 3 aspects. First, there are researches on design according to ADDIE (Analyze, Design, Development, Implementation, Evaluation) activities. Second, there are researches that consider MOOC elements for learner when designing. Last, there are researches that consider various aspects of MOOC characteristics in terms of a designer.

In the research by Vladimir (2012), cMOOC course was designed using ADDIE activities. However, the various MOOC design elements suggested by precedent studies, mentioned above, may not be reflected when the design is based on a general instructional design model, without considering the characteristics of MOOC.
Table 2. Activity by step comparison of e-learning instructional design development model

<table>
<thead>
<tr>
<th>Model</th>
<th>Analysis</th>
<th>Design</th>
<th>Development</th>
<th>Implementation</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>NHED model (Jung, 1997)</td>
<td>Needs analysis: Content analysis, Learner analysis, Tech/environmental analysis</td>
<td>Content design: Instruction design, Standard design</td>
<td>Development</td>
<td>Preparation, Process operation</td>
<td>Academic achievement evaluation, Process-effect evaluation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Lee (2002)                  | Needs analysis, Learner analysis, Task analysis, Environmental analysis   | Content design: Instruction design, Multimedia design, Interface design, Storyboard/storyboard design | Writing tool selection: Production, Formative evaluation, Model operation   | Preparation, Operation                                       | Academic achievement evaluation, Curriculum effect evaluation, Cost-effect evaluation |


| KT-WHED                     | Overall analysis: Learning analysis, environmental analysis, E-learning education development design, Planning | Design summary framing: Content/activity design, Instruction & e-activity design, Media design (interface screen, storyboard, storyboard design), Learning achievement evaluation design, Curriculum coordination | Prototype development: Production (programming), Before education, During education | Before education, After education | Academic achievement evaluation, Program evaluation                        |

| Lee & Gweon (2002)          | Formal analysis: Learner, Learning environment, available resource analysis, Planning | Info suggestion: Learning society & exercise design (individual, cooperative) | Instructional strategy selection: Learning content hierarchy, Learning tool, Resource development to be used | Learning procedure formation | Implementation & evaluation                                                |

| Dossi (2002)                | Selection of technological type using e-learning | Synchronous or asynchronous interaction design |                                                        |                                           |                                                                           |

Research by Guàrdia, Maina, & Sangrà (2013) suggested 10 elements of supporting learning to be provided for learners in the MOOC environment. The elements are as follows: competence-based, learner empowerment, personal learning plan, collaborative learning, social networking, peer assistance, quality knowledge creation, interest groups, assessment and peer feedback, and media-tech enhanced learning. However, it only enumerates the importance of learning support elements for learners but fails to suggest a design procedure.

Scagnoli (2012) suggested 5 main elements for increasing learning effects of learners through MOOC in the MOOC instructional design. Such elements include lecture of a novel theme influencing on prior experience, provision of abundant learning materials, inducing of deepened thinking, motivation for community learning opportunities and planning of further learning. This research suggests how to design a MOOC lecture so that it can make learners experience the elements in order, but it has limitations in that it did not provide precise segmented steps.

Lim & Kim (2014) researched design elements of Korean-typed MOOC based on SWOT analysis. As a result of SWOT analysis, 7 design elements were suggested including the type of organization, age of learners, lecture areas, authority to open courses, contract unit, teaching qualification and system connection. However, this research provides the methods to derive elements that should be considered and to search for a direction of a decision rather than without suggesting when each element is to be considered in each stages of designing.

Lim, Kim, Kim, Han, & Seo (2014), based on an edX case at Seoul National University, which operated MOOC as the first runner in the country, suggested subjects and procedures, relations and roles among subjects for selecting, designing, opening and implementing an actual course. This research described roles of each subject but left to be desired in showing a systemic step to be followed when designing a general MOOC.

In the instructional development, model is a conceptual tool to visualize and describe a development process of an instructional program, taking a role of an
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instrument for correct communication within a development team (Gustafson & Branch, 1997). Besides, instructional design development model has a character of practice and prescription to inform instructional designers of the entire development process of an instructional program rather than being used to form a theory or describe and foretell a phenomenon (Rha & Chung, 2003). However, as shown from above, MOOC research so far couldn’t present a practical and prescriptive design model. Therefore, it is necessary to research a design model that considers design elements reflecting MOOC characteristics systemically.

**Method**

In this study, the methodology was model construction and model validation of Richey and Klein (2007). Literature review and expert review are adopted for the model construction. Internal validation is conducted as the instrument for validating. After that, external validation can be used for testing model usability. Detailed methods that this study employed are as shown in Table 3.

<table>
<thead>
<tr>
<th>Components</th>
<th>Steps</th>
<th>Methods</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model construction</td>
<td>Literature review</td>
<td>Literature review</td>
<td>Model and components</td>
</tr>
<tr>
<td></td>
<td>Expert review</td>
<td>Expert review</td>
<td>Model revision</td>
</tr>
<tr>
<td>Model validation</td>
<td>Internal validation</td>
<td>Internal validation Test</td>
<td>Model revision</td>
</tr>
<tr>
<td></td>
<td>Field test</td>
<td>Field test (Interviews and</td>
<td>Teacher’s evaluation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>questionnaire of teachers and</td>
<td>Learner’s evaluation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>learners)</td>
<td></td>
</tr>
</tbody>
</table>

9
Research activities and methods

**Literature review**

To develop the MOOC design model, literature review is conducted as shown in Table 4. Because there is little research related to MOOC design and design models which adopted MOOC traits, researchers’ discussion plays an important role in the 1st MOOC design components.

<table>
<thead>
<tr>
<th>Table 4. E-learning, MOOC design and development model related literature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sectors</td>
</tr>
<tr>
<td>E-learning Design and development model</td>
</tr>
<tr>
<td>MOOC design and development model</td>
</tr>
</tbody>
</table>

**Expert review**

The purpose of expert review is to (1) Evaluate model theorization process validity, and (2) Revise the model for improvement. The expert profiles are shown in Table 5.

<table>
<thead>
<tr>
<th>Table 5. Expert review expert profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experts</td>
</tr>
<tr>
<td>Experts A</td>
</tr>
<tr>
<td>Experts B</td>
</tr>
<tr>
<td>Experts C</td>
</tr>
</tbody>
</table>
Table 6. The instrument for validating the model theorization process

<table>
<thead>
<tr>
<th>Items</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehensive literature review</td>
<td>Relevant literature was comprehensively reviewed to construct the MOOC design model</td>
</tr>
<tr>
<td>Appropriate terminology</td>
<td>Appropriate terminology was used to describe the MOOC design model</td>
</tr>
<tr>
<td>Appropriate interpretation and summary by reviewed literature</td>
<td>Reviewed literature was properly interpreted and summarized to develop the MOOC design model</td>
</tr>
<tr>
<td>Appropriate reflection of literature review</td>
<td>The information gained from literature review has been properly reflected</td>
</tr>
<tr>
<td>Logical organization</td>
<td>MOOC design model is logically well organized</td>
</tr>
</tbody>
</table>

Three experts were interviewed face to face for about one to two hours. The researchers debriefed the model theorization from literature review. Especially, researchers emphasized that researchers’ discussion is the key of constructing the 1st MOOC design components. The instrument for validating model theorization process is adopted from several studies (Kim, 2013; Lee, 2013; Rha & Chung, 2001). Experts were asked to review content validity of the model. Researchers revised the model based on expert’s comments.

**Internal validation**

The internal validation test aims at (1) Reflection of expert review comments (2) Evaluation of internal validity (3) Revision of model for improvement. Internal validation test is conducted by three educational technology and MOOC researchers who have already participated in the expert review and two additional instruction design experts. The expert profiles are shown in Table 7.

The instrument for validating the model is adopted from Kim (2013), Rha & Chung (2001), Lee (2013)’s study and revised for the research purpose. Items of internal validation instrument are as shown in Table 8.
Table 7. Internal validation expert profile

<table>
<thead>
<tr>
<th>Experts</th>
<th>Position</th>
<th>Expr. (year)</th>
<th>Expert fields</th>
<th>ETC</th>
<th>ETC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experts A</td>
<td>MOOC Researcher, instruction design experts Ph.D</td>
<td>8</td>
<td>Educational technology, instruction design</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experts B</td>
<td>Professor, Ph.D</td>
<td>10</td>
<td>Educational technology, e-learning</td>
<td></td>
<td>Expert review</td>
</tr>
<tr>
<td>Experts C</td>
<td>Researcher, Ph.D</td>
<td>9</td>
<td>Educational technology, game based learning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experts D</td>
<td>Professor, Ph.D</td>
<td>11</td>
<td>Educational technology, problem based learning</td>
<td></td>
<td>Experts</td>
</tr>
<tr>
<td>Experts E</td>
<td>Researcher, Ph.D</td>
<td>10</td>
<td>Educational technology, cognitive science, learner modeling</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 8. Items of internal validation

<table>
<thead>
<tr>
<th>Items</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Validity</td>
<td>The model contain the process and components of designing MOOC</td>
</tr>
<tr>
<td>Comprehensibility</td>
<td>The model is easy to comprehend</td>
</tr>
<tr>
<td>Explicability</td>
<td>The model helped me figure out the flow of MOOC design and ways to doing</td>
</tr>
<tr>
<td>Usability</td>
<td>The model enable me to design MOOC</td>
</tr>
<tr>
<td>Generality</td>
<td>The model enables me to design MOOC for wide variety of digital text</td>
</tr>
</tbody>
</table>

From internal validation test, quantitative data of experts’ ratings were analyzed and reported with the CVI (Content Validity Index) and IRA (Inter-Rater Agreement). According to Rubio et al (2003), CVI can be calculated by counting the number of positive rating 3 or 4 in 4-point scale and dividing it by the number of experts. Higher than .80 is recommended.
External validation

Along with the internal validation test as described, as a next phase, external validation has been conducted. The external validation is to test model's effectiveness, efficiency, and usability in a real field. To report the effects of usage of models, it can be revised for improvement and identified by field test (Richey & Klein, 2007).

One high school teacher, who was interested in design and development of MOOCs lecture, participated in the research. The instructor's course title was 'Jump into Haiku' in Eliademy. 12 attendees of the MOOCs lecture, opened by the research participant, took part in research as student participants. Profiles of the research participants are shown in Table 9.

<table>
<thead>
<tr>
<th>Research participants</th>
<th>Position</th>
<th>Expr. (year)</th>
<th>Department</th>
<th>Expert fields</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructor</td>
<td>High school teacher</td>
<td>7</td>
<td>English</td>
<td>English education, Educational technology</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Research participants</th>
<th>Position</th>
<th>Age</th>
<th>Gender</th>
<th>Experience of MOOCs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student A</td>
<td>College graduate</td>
<td>20-25</td>
<td>F</td>
<td>Under 1 course</td>
</tr>
<tr>
<td>Student B</td>
<td>College graduate</td>
<td>26-30</td>
<td>F</td>
<td>Under 1 course</td>
</tr>
<tr>
<td>Student C</td>
<td>High school student</td>
<td>20-25</td>
<td>F</td>
<td>Under 1 course</td>
</tr>
<tr>
<td>Student D</td>
<td>High school student</td>
<td>20-25</td>
<td>F</td>
<td>Under 1 course</td>
</tr>
<tr>
<td>Student E</td>
<td>Undergraduate</td>
<td>20-25</td>
<td>F</td>
<td>2-5 courses</td>
</tr>
<tr>
<td>Student F</td>
<td>Undergraduate</td>
<td>26-30</td>
<td>F</td>
<td>Under 1 course</td>
</tr>
<tr>
<td>Student G</td>
<td>Undergraduate</td>
<td>20-25</td>
<td>F</td>
<td>Under 1 course</td>
</tr>
<tr>
<td>Student H</td>
<td>College graduate</td>
<td>26-30</td>
<td>F</td>
<td>Under 1 course</td>
</tr>
<tr>
<td>Student I</td>
<td>Master's graduate</td>
<td>26-30</td>
<td>F</td>
<td>2-5 courses</td>
</tr>
<tr>
<td>Student J</td>
<td>Undergraduate</td>
<td>20-25</td>
<td>M</td>
<td>Under 1 course</td>
</tr>
<tr>
<td>Student K</td>
<td>College graduate</td>
<td>20-25</td>
<td>F</td>
<td>Under 1 course</td>
</tr>
<tr>
<td>Student L</td>
<td>College graduate</td>
<td>26-30</td>
<td>F</td>
<td>Under 1 course</td>
</tr>
</tbody>
</table>
Field test for instructor about MOOC design model

Questionnaire on perception of an instructor on the effect of MOOCs design model was composed of two parts. First, model's usability evaluation. It consisted of 5 multiple-choice questions on the usability of the design model for the instructional design and 4 open-ended questions on strong and weak points of the model with improvement. Second, model's effectiveness evaluation. Also, there were 17 multiple-choice questions on how much a guideline of each step was helpful for design.

Field test for students about MOOC design model

Validation test for learners about the design model consists of questions to evaluate students' response, whether model developed was effective for learning process and activity in an actual learning situation. To evaluate learners' response to effectiveness of the model, it was composed of 2 open-ended questions on strong and weak points, improvement to be required in 11 selective lessons.

Results

The MOOC design model was developed from 2 phases. Firstly, through reviews of literature, the components of MOOC design were derived, structured and presented as a model. Secondly, revision was conducted by expert review and validity evaluation.

Model construction by reviewing literature

The initial model was constructed based on reviews of literature. The model is composed of 6 steps: analysis (1st Iteration), design, development, implementation, evaluation and analysis (2nd Iteration). The draft of MOOC design model is shown
in Figure 1.

![MOOC design model draft](image)

**Figure 1. MOOC design model draft**

**Model revision by expert reviews**

The purpose of this step was to evaluate adequacy of model exploration literature, adequacy of term, adequacy of literature review, reflected literature review result, model organization, activities and terms of each item of analysis, design, development, implementation and evaluation of the model draft. Opinions of 3 experts and revision from in-depth interviews are as follows.

**Adequacy of exploration literature, literature review, reflected literature review result**

There is little research related to MOOC. When reviewing e-learning literature, it is needed not to forget that this study is research on MOOC. Model should be
designed to show the unique characteristics of MOOC. As a result of reviewing literature, there was no significant difference from an e-learning model. So characteristics of MOOC should be more emphasized.

**Adequacy of model organization**

It is necessary to make sure that the elements are included in the MOOC design model, readjusting a course by learner’s needs in course implementation.

**Adequacy of activity & term by step**

**There are some elements that must be considered at each step.**

Analyze: It is important to set the objectives for development before analyzing the developmental environment. This is because, depending on the objectives, the model can be developed into either xMOOC or cMOOC. Besides, it is regarded that a strategy for delivery should be considered in the shadowing part. When analyzing the developmental environment, first, it is required to segment a platform analysis into those on platform trend and function. Second, certain trends and techniques should be analyzed and reflected including video production technologies.

Design: When designing learning contents, accuracy and up-to-dateness are the most essential elements, as these features may be the reasons why learners listen to MOOC. Along with follow-up measures, linkage to the next class is needed. Elements that considering lecture segment time and caption location, graphic insertion should be added. In particular, it should be emphasized that learner can see a pertinent image when clicking a caption through synchronization of caption and image. Furthermore, as for the style design, infographic design may be included. It is also necessary to design how to organize a trailer (preview course) when designing an image.
Implementation: It is important to emphasize implementation more than any other parts. In the Implementation, notice and questions & answers are needed. It is necessary to examine how instructor, learner and TA interact with each other in an Implementation process. The term ‘Needs adjustment’ seems to be improper in the implementation step. ‘Learner Response’ seems to be desirable. When designing a course, since a course is operated after setting an evaluation ratio and a certificate standard, course readjustment is difficult to be done in the implementation. Accordingly, it is proper for course readjustment to be done at the 2nd analysis step after evaluation.

Evaluation: It is better to conduct both quantitative and qualitative evaluations together. Also, more specific description about items seems to be necessary including whether learners reacted according to an objective or not along with completion ratios. The model derived from revision by expert pre-review is like Figure 2 below.

Figure 2. MOOC design model reflecting expert pre-review opinions
Model revision by internal validity

MOOC design model was evaluated on its internal validity (comprehensibility, explicability, usability and generality of the model) by 5 experts and revision based on the in-depth interviews are as follows.

<table>
<thead>
<tr>
<th>Area</th>
<th>Expert evaluation</th>
<th>Mean</th>
<th>SD</th>
<th>CVI</th>
<th>IRA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>Validity</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Comprehensibility</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Explicability</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Usability</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Generality</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

As a result of examining internal validation of the MOOC model reflecting expert pre-review opinions, the mean ranges from 3.4 to 3.8. Content validity index (CVI) and Inter-rater Agreement (IRA) showed 1 in 5 items.

However, it shows that MOOC design model is valid and reliable. For Internal validity, expert interviews were recorded and analyzed by the researcher. Expert opinions and revisions on the general MOOC design model are as follows.

Design: It is necessary to subdivide each item into content and style designs.
Development: It is difficult to conduct a pilot test at a field.
Implementation: In the existing model, it is impossible to adjust considering responses of learners in online courses where large-scaled attendees participate, so learner responses should be identified. A step planning is, which comes before course implementation establishment of course implementation strategies, setting of open time by week, is important.

MOOC design model reflecting revisions is as follows.
Model revision by external validity

External validation was conducted for instructor and learners to identify if the proposed model was adequate to be used in a field.

Firstly, instructor evaluated usability and effectiveness of the model after designing and opening a lecture according to the model.

As for the question whether the model was helpful for an instructional design, it showed a higher score of the average 3.8 for instructors. Also, as for the question how much a guideline of each step was helpful for the design, it showed a higher score of the average 3.47. Accordingly, it was identified that instructors showed a positive response to the proposed model of this study.

On the open-ended question, the instructor mentioned that proposed model has 2 kinds of strengths. First, while opening the MOOC lecture, they said it summarizes systematically steps for achieving the final objective of class through
learning contents rather than only provides learners with them. Next, they described that plans established by step, composed of essential elements for the procedure, prevent instructors merely equipped with enthusiasm from producing MOOC contents, enabling them to design and apply a lecture in a careful manner.

However, the instructor said that it is difficult to apply a developmental objective of MOOC lecture actually if it is based on a personal dimension. For instance, it is difficult for individuals to organize a PR strategy, design info-graphics, shooting a lecture and produce captions. Thus, he said such things should be complemented. In addition, the instructor suggested an opinion that it is desirable to propose a simplified model that may be applied in a personal dimension. Besides, there was an opinion that designing and developing a lecture will be easier if a standard example is provided together for the development of an evaluation tool or design of content.

After learning this lecture, responses of 12 learners were analyzed to identify effectiveness of lecture where the proposed model of this study was applied. The mean, standard deviation and the minimum/maximum values of each question were used for analysis on effects of the lecture. The findings are like Table 11 below.

Based on results in Table 10, strengths, weaknesses and improvements that learners perceive on class centered on the proposed model of this study can be summarized as follows.

Firstly, as strengths, this study identified that content of a lecture was easy to understand generally and videos were helpful for self-regulated learning since they were divided into a short unit. Furthermore, there was an opinion that various kinds of images were exciting. It corresponds to opinions on questions like ‘Learning content of the lecture was easy to understand’ and ‘Multimedia of the lecture gave aid to learning’ getting the highest mean scores from multi-choice questionnaires.
Table 11. Results of learner response to effect of lecture using MOOC

<table>
<thead>
<tr>
<th>Question</th>
<th>M</th>
<th>SD</th>
<th>Min value</th>
<th>Max value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title or introduction of this MOOC lecture was interesting.</td>
<td>3.08</td>
<td>0.67</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Learning objective of this MOOC lecture was suggested clearly.</td>
<td>3.33</td>
<td>0.78</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Learning content of this MOOC lecture was easy to understand.</td>
<td>3.50</td>
<td>0.52</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Learning amount of this MOOC lecture was suggested properly by week.</td>
<td>3.25</td>
<td>0.61</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Letter type, color and size of each screen text were appropriate.</td>
<td>3.33</td>
<td>0.65</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Meaning of interface (menu, icon, button) used at this MOOC lecture was clear.</td>
<td>2.83</td>
<td>0.72</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Multimedia of this MOOC lecture including texts, pictures and videos were suggested properly.</td>
<td>3.25</td>
<td>0.62</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Multimedia of this MOOC lecture including texts, pictures and videos gave aid to learning.</td>
<td>3.50</td>
<td>0.67</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>This MOOC lecture was helpful for academic achievements.</td>
<td>3.25</td>
<td>0.45</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>This MOOC lecture was helpful for inducing &amp; maintaining learning motivation.</td>
<td>3</td>
<td>0.85</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Have an intention to learn a task or a theme hereafter if lectures like MOOC are provided.</td>
<td>3.17</td>
<td>0.72</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

Next, compared with results of multi-choice questions, detailed weaknesses and improvements of the MOOCs lecture mentioned by learners from open-ended questions are as follows.

First, in multi-choice questions, question 'Meaning of interface (menu, icon, button) used at this MOOCs lecture was clear' showed the lowest mean scores (2.83). Related to this above, students suggested opinions as follows.

*Student A:* I have to listen to it while changing a study mode at a step learning words using a flashcard. Seems to be easier to use if there is an additional...
explanation on how to use it.

Student C: I wander around a lecturing site because of unclear meaning of interface.

Student E: Download and memo icons do not catch my eye. I think because there's no explanation on icons.

Student F: Interface was unfamiliar to me so maybe it was not clear what button I push to go forward next step. So confused. Because I don't know how to approach task-related tasks and explanations.

Consequently, it is necessary to offer additional explanations if there is no detailed descriptions on interface or learning method in the implementation step of this model.

Secondly, in multi-choice questions, question ‘Title or introduction of this MOOCs lecture was interesting’ showed the secondly lowest mean scores (3.08). Related to this above, learners suggested opinions as follows.

Student I: If guidance on Task of this lecture is provided in advance, or it is given below the related video, maybe I think it’s Okay.

Student B: I want you to point out important things before lecture.

Such opinions show that consideration is needed on the simple introduction of a lecture causing learners’ interest in addition to a title of a lecture in a style design step.

Finally, in multi-choice questions, question ‘This MOOCs lecture was helpful for inducing & maintaining learning motivation’ showed the thirdly lowest mean scores (3.0) with the highest standard deviation. It means that lecture should be designed considering learners’ individual differences including preference and prior knowledge to achieve learning motivation. Related to this above, opinions of learners are as follows.
Student C: Seems that contents to induce and maintain learners' motives 'should be included 'as expected', 'what learners can do through learning' in addition to learning contents.

Student E: Had better refer to tasks others did. It will be more interesting if I can see what and how others did, share opinions with them.

Student I: Learning contents are mainly suggested by videos but I want proper placement with other elements like text or image to be taken into account.

Student H: Maybe it's okay if colloquial-styled guide is provided like guidance by an instructor in every activity or video to feel a sense of presence.

Besides, there was an opinion on lacking in multimedia or other elements inducing interest because of interface of the site.

Student B: I think it's desirable if design is improved including layout of text, pictures and videos with interface improvements convenient for learners.

Student E: Experienced decreased concentration owing to small size or low volume of videos. I wish I'd control it.

In conclusion, it shows that detailed teaching-learning strategy is needed to induce motivation of learners in the learning content design. Also, based on findings that platform components have an effect on inducing and maintaining motives of learners, preference and taste of a learner should be considered at the platform analysis, developmental environment analysis step of this model.

According to Richey and Klein (2007), if a field evaluation is used for validation of a model, a basic model may be confirmed or corrected based on examination of its results. Therefore, the final model reflecting expert validation, internal/external validation results is as follows.
Figure 4. The final model
**Analysis (1st iteration)**

**Goal Setting.**

Student Prediction: In this stage, the course designer makes assumptions to predict the target students that could register for MOOC. Development goals and contents must be established based on these assumptions that consider the cultural factors, technological conditions, linguistic aspects, and historical factors of the predicted student.

Purpose Identification: In this process, the designer identifies the purpose of the MOOC offered. The purposes can be subdivided into three dimensions: national, institutional and individual. For example, realization of lifelong education or renovation of national image can be the purpose at the national level. At the institutional (university) level, university promotion can be a purpose.

**Environment Analysis.**

Platform Analysis: MOOC Platform Analysis can be divided into platform type and platform function analysis. Depending on the type of MOOC platform (example: cMOOC, xMOOC), the most appropriate form of MOOC platform can be selected. Also, the appropriate platform can be selected based on the functions provided by various platforms such as edX, udemy and moodle. Moreover, it should be selected along with learner's characteristics. Such as learner's preference, preliminary experience of platform, visual tendency et al.

Trend Analysis: As for video shooting, video contents are the main media of MOOC. Therefore it is essential to analyze and apply the latest techniques for shooting. Also, it is important to select the most appropriate video shooting techniques based on the features of the course.
Design

Contents Design.

Contents Selection: Contents selection is related to selecting the main contents of the course, which is the main component of MOOC. In this stage, it is important to consider the student’s interest, include motivational contents. Also, the design must include edutainment components that can maintain student’s interest and motivation throughout the course. In addition, the MOOC contents must contain the most up-to-date information, while the accuracy of information guaranteed. To attract and meet the needs of MOOC participants, it is essential to design contents based on the most recent and accurate information in this rapidly changing society.

Scope · Goal Setting: Once the most recent and accurate information is selected, one must decide the scope of the contents that would be presented in the MOOC lecture. After setting the scope, a viable goal within the contents scope should be established.

Video Design.

Preview (Trailer) Design: Previews provide information to students in advance of course registration. Preview contents must include the main information necessary for students to select the course, and factors that can increase their interests in the topic.

Main Video Contents Design: As most MOOC lectures are offered in the form of video, the video contents design stage could be highly important. First, the designer must decide the time length of each video lecture. Normally, it is best to segment the time length on the basis of 3-6 minutes in order to have high viewing rates. However, one can adjust the time length considering the characteristics of the
study field or topic, and the types or number of learning activities that are presented in the course (Lim et al., 2014).

**Learning Resources Design.**

Learning Materials Design: Learning materials are the various materials provided to students from basic to advanced level. It must be designed so that students can have access to basic or advanced materials based on their level of understanding.

**Learning Activity Design and Development.**

Massive Learning Activity Design: At the stage for learning activity design, the designer must take into consideration that MOOC targets a mass of learners. The learning activities should be able to satisfy the different needs of students as much as possible. Also, it should be designed to be convenient for managers to manage the massive learning activities.

Construction of Small Scale CoP Considering Students’ Characteristics: MOOC course should not only provide learning activities but also small scale CoP (Community of Practice) for the mass of learners. MOOC course must take account of the different characteristics of students including regional, cultural, religious and historical aspects.

**Evaluation Tool Design.**

Evaluation Question Design: After setting goals, corresponding Evaluation questions must be constructed. Evaluation question design can be divided into formative evaluation and summative evaluation. Formative evaluation is related to assessing the learning outcomes of students. The selection of task types and the evaluation ratio of quiz or assignments depend on whether individual evaluation or group evaluation would be carried out. Summative evaluation, which assesses the lecture, includes evaluation of goal achievement, completion rates of students and
Evaluation Criteria Setting: First of all, the designer should establish a criterion for evaluation to assess the learning outcomes of students. Based on this criterion, the designer must also set the criteria for issuing certificates of achievement.

**Style Design.**

Course Name Selection: As MOOC targets a diverse range of students, it is important to create a course name that can arouse students’ interests, while delivering the main contents of the course at the same time.

Attractive Course Description: After instructor decide the course name, course description should be provided. Since it's the important indicator for students to decide whether take the course or not, it must be attractive. Not only the content's basic information, also importance, necessity and benefit of this course should be described in course description.

Promotion Strategy Formation: As there are various lectures provided through MOOC, it is necessary to have a promotion strategy. There are two types of promotion strategies: strategy to increase the participation of students who have already registered for the course, and strategy to attract potential students. For the students who have already selected the course, guidelines such as course name, profile (contact information) of professor and syllabus should be noticed in advance. Also, additional information such as course timeline or weekly notices can be sent by email in order to help students keep up with the courses and maintain their interests. For potential students, the course can receive attention by uploading trailers and course information.
Infographic Design: This design can introduce and present course information in a more attractive way. For students who take the course, information can be delivered more effectively and efficiently through infographic design. For potential students, the course could seem more appealing.

**Development (course development)**

**Video Contents Development.**

Lecture Video Shooting: At this stage, the designer develops the lecture video, which is the main component of MOOC. Video shooting of the lecture takes place considering the time length, which reflects the characteristics of the study field or topic, and the types and number of learning activities.

Adding Caption: In this stage, the designer adds appropriate captions to the video. Captions should be produced considering two aspects. First, the designer must understand the knowledge level of the expected students to decide the concreteness of the caption contents. For instance, in the case where most of the students are at the beginner level, it may be more effective to have captions in a concrete form. Second, the designer should identify the native languages of the students and make sure that the captions are offered in the appropriate language. For example, when a lecture is provided in English and most of the students are not native English speakers, the designer may provide captions in other native languages.

**Learning Resources Development.**

Learning Materials Development: In this stage, the learning materials that were designed in the previous stage are developed. Rather than developing all of the materials from the beginning, the designer should start searching for existing materials. When using an existing material, it is important to clearly identify the
source.

**Evaluation Tool Development.**

Evaluation Question Development: In this stage, the specific questions for evaluation are developed. The designer should develop the items considering certain factors (different characteristics of item types, strengths and weaknesses, complexity, etc.). In order to find an objective standard, the multiple choice item type is the most frequently used item type.

**Implementation**

Course Implementation Strategy Establishment: In this stage, management plans are established and the roles of the lecturer and TA should be specified. Especially in the case of MOOC, the role of the TA is essential as a large number of students need to be administered. Therefore, it is highly necessary to discuss in advance how the TA could support the lecturer.

Setting Weekly Course Opening (Setting Course Timeline): Considering the video and learning materials, the designer decides when each lecture should be opened to students each week. The entire lecture video and materials could be uploaded from the beginning, allowing students to control their own learning pace. On the other hand, the lecturer can upload the lecture video and materials based on a certain timeline to control the learning pace.

**Course Implementation.**

Learning Support (Pre, middle, Post Assistance/Feedback/Supervision of learning method): Implementation starts with the first course opening. Weekly announcements, learning materials and video materials are uploaded based on the syllabus.
Evaluation

Summative Evaluation.

Quantitative Evaluation: The course is evaluated quantitatively and three types of quantitative evaluation are carried out. The first evaluation is related to completion rates. By finding out the dropout rates, the completion rates of the entire students are assessed. Second, criteria such as quiz, assignments and level of participation are considered to assess the students’ level of academic achievement. Lastly, goal attainment is assessed. It is necessary to evaluate whether the development purpose (goals) identified in the analysis stage are achieved or not.

Qualitative Evaluation: In this stage, qualitative evaluation of the course is conducted in two directions. First, goal attainment is assessed. It is necessary to evaluate goal attainment qualitatively along with the quantitative evaluation. Second is satisfaction evaluation. It is important to assess the level of satisfaction of all stakeholders who participated in the designing and management process of MOOC, including students, lecturers, designers and TAs, and identify the reasons for their answers.

Analysis (2nd iteration)

Need Reflection.

Qualitative-Quantitative Readjustment of Course (Learning) Contents: In this stage, qualitative and quantitative readjustment are made based on the student response of the course. Reflecting the evaluation on student satisfaction, completion rate and academic achievement, the designer readjusts the course contents qualitatively and quantitatively.

Qualitative-Quantitative Readjustment of Assignments: Along with the course contents, qualitative and quantitative readjustment of assignments is carried out
based on the assessments on student satisfaction, completion rate and academic achievement

Readjustment of Message Design and Method of Delivery (Delivery Method, Communication Methods): The designer verifies to make sure that the course has been designed suitable to the technological conditions or personal preference of students, which were predicted in the student prediction stage. Then, reflecting these factors, readjustment of message design and method of delivery is carried out.

Discussion and Conclusion

Since the article titled ‘The Year of the MOOC’ by the New York Times on the November 2nd, 2012, came out, MOOC has been attracting attention and expanding globally as a new educational paradigm. Moreover, design and utilization of MOOC are being conducted actively in the field. However, in the case of MOOC, practice excels research by far so there are few studies suggesting a design model as a specific procedure despite its necessity. Therefore, systematic research about MOOC design principles and development processes is needed.

Based on such necessity, MOOC design model is to be constructed giving guidance on design activities in a concrete manner considering its characteristics. As an attempt to satisfy practical and theoretical demands for exploration on MOOC design model, this study was conducted to develop a model to be used for designing MOOC. Therefore, this study examined components of MOOC design and developed the design model including course development procedures and activities.

The research questions for this study are addressed below: (1) What is the MOOC design model reflecting MOOC characteristics? And (2) Does the MOOC design model reflecting MOOC characteristics have a positive effect on satisfaction
of instructor and learner? As two research questions and internal/external validations of model development and model validation by Richy and Klein (2007) were used as the research methodology.

As a result, 6 procedural phase and 9 specific steps were derived. Procedural and specific steps are as follows. Firstly, it is an analytic phase. The analysis phase contains setting of a developmental objective and analysis of a developmental environment. The developmental objective setting contains predicting potential learners who are to attend an opened MOOC and an item identifying a developmental objective for opening MOOC. The developmental environment analysis contains an item analyzing a platform for its type and function and an item analyzing a trend to analyze and reflecting the latest shooting technologies. Secondly, it is a design phase. The design phase is composed of content and style designs steps. The content design contains selecting learning contents, significant MOOC components, and setting a scope objective to the extent that relevant information is provided on the MOOC lecture. Furthermore, content design contains a video design (1. Preview (trailer design), 2. Main video design), learning resource design (learning material design), learning activity design & development (1. large-scaled learning activity design, 2. small-scaled CoP construction considering learner’s characteristics). Evaluation tool design (1. evaluation item design, 2. Evaluation standard selection). Style design contains a step to select course title inducing learner’s interest and an infographic design to construct a PR strategy, introduce a lecture and present lecture contents more attractively. Thirdly, there is a development (lecture development) step. Video development contains development of images (1. lecture shooting, 2. caption production), development of learning resources (learning material development) and that of evaluation tools (evaluation item development). Fourthly, there is an implementation phase. The implementation phase contains step before lecture implementation (1. strategy establishment for operating a lecture, 2. open time setting by week) and a lecture implementation. Fifthly, there is an evaluation phase. Evaluation phase contains
summative evaluation including quantitative and qualitative evaluations. Sixthly, there is an analysis (2nd Iteration) phase. As the 2nd Iteration phase is done before implementation of a new course, it contains qualitative-quantitative re-adjustment of learning contents. Also, learning tasks, message design and communication methods should be re-adjusted.

This study has significance in that it suggested the systemic MOOC design model to give guidance for design activities while considering MOOC characteristics. As a prescriptive model to suggest guidelines and directions required for MOOC design and implementation through 6 procedural phase and 9 specific steps, it is expected to give specific guidelines to those who design MOOC. As mentioned from limitations of this study above, further study is needed to differentiate roles of instructors and instructional designers who participate in MOOC design and implementation, suggest the resulting design strategies and investigate positive effect on learning outcome of learner when adopted MOOC design model reflecting MOOC characteristics.
A Study on the Development of a MOOC Design Model

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