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PROMOTING SCIENCE CENTERS BY USING MOOCS: MODEL FOR COMMUNICATING INFORMAL SCIENCE EDUCATION

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The present study aims to analyze how Massive Open Online Courses (MOOCs) as a way to promote science centers in Indonesia. The study used literature review by using sources-selectivity process. The review comprised three phases: planning, modelling and reporting. Some resources: books and journal papers were selected to perform the model for communicating informal science education. The results of the study indicated that the possibility for applying MOOCs as media and an alternative model to the future distance learning. MOOCs might be a way to how education is delivered and consumed both in formal and informal education. In particular, Indonesia has a large capital related to the number of the science centers, including the science museum, cultural institution and a national park that is not widely known by the public. Therefore, the role of MOOCs in promoting science centers are indispensable.

Keywords: MOOCs, science centers, informal science education, Indonesia

Introduction

MOOCs (Massive Open Online Courses) can be seen as a term related to the massive learning, open sources, and online education. MOOCs are courses designed for large numbers of participants, that can be accessed by anyone in everywhere as long as they have an internet connection are open to enjoy and to explore the certain content. MOOCs had exploded into the academic view in summer 2011, when afree course offered by Stanford University attracted 160,000 students from around the world — 23,000 of whom finished it (Waldrop, 2013).In 2010 Siemens (in McAuley, *et al.*, 2013) described MOOCs as:

> "An online phenomenon gathering momentum over the past two years or so [… integrating] the connectivity of socialnetworking, the facilitation of an acknowledged expert in a field of study, and acollection of freely accessible online resources [… that] builds on the active engagement of several hundred to several thousand 'students' who self-organize their participation according to learning goals, prior knowledge and skills, and common interests."

The quotation above give implication that there are four 4 characteristics in open online, including: social networking, acknowledged expert, freely accessible resources, and self-organize participation. MOOCs have compiled great support from the world leading institutions over the past five years. Partnerships among leading universities have setup platforms like *Coursera, Edx*, and *Udacity* that

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continue to benefit tens of thousands of students around the globe.MOOCs targeting unlimited participants and open access through website. Inpractice, in addition to the traditional learning such as videoand readings, they provide a place for interaction between users to help create a community for students, teachers, andgeneral public through internet.Over little more than a year, the usage of this media is rising. For instance, Coursera in California is the largest of three companies developing and hosting MOOCshas introduced 328 different courses from 62 universities in 17 countries (Waldrop, 2013).

It is possible in thefuture if MOOCs will be applied in Indonesia as an alternativemodel to the current distance learning.Based on the statistical data, the number of internet users in Indonesia based on Indonesian Internet Service Provider Association (APJII) only, in 2015 reached about 88.1 million from 71.9 million users in 2013 (Maulana, 2015). However, the previous study precisely estimated that the total number of internet users were 63 million in 2006 and it will reach about 107 million users in 2014 and 139 million users in 2015(Soekartowi, 2006). The fast growth of Internet is very supportive to distance learning development in Indonesia.

The distance learning had been used for the past years in Indonesia. One of the oldest model was E-learning. Universitas Terbuka (Open University) in Indonesia has implemented E-learning since 1999 (Tri, Made, & Boedhi, 2007).Another model of distance learning that already used was Blended E-learning. The model "BEL", was designed basically based on combination of the best aspects of application ofinformation technology E-Learning, structured face-to-face activities, and real world practice. Indonesia also familiar with the provider of MOOCs, such as *Harukaedu*, *Codemi*, and *Wikasa* but all of them have no partnershipsamong leading universities. On the future of this partnership is very urgent to maintain the quality of the content of the courses offered by joining with universities' scholar.

Based on the rationale above, it is possible to apply MOOCs in Indonesia. MOOCs can be applied in formal learning as well in informal learning, such as informal science education. Moreover, the country is also rich on science centers, including the science museum, cultural institution, and a national park that is not widely known by the public. At a broader level, the release of a new journal in informal science education, such as International Journal of Science Education (IJSE) Part B: Communication and Public Engagementin 2011 and Public Understanding of Science (PUS), etc will address the communication between citizens. In addition, the engagement by individuals and groups concerning evidence-based information about the nature, outcomes, and social consequences of science and technologyalso also undergoing expansion.Therefore, the role of emerging MOOCs in promoting science centerswere indispensable. Thus, this paper tried to design a model of how to promote science centers.The paper also performed

an analyzes how MOOCs can offer an alternative distance learning model to optimize science centers in Indonesia.

Study Methods

This study has been undertaken as a systematic literature review based on the need assessment and some evidence regarding the science centers in Indonesia. The review processes comprise three phases: planning, modelling and reporting. In the planning activity, the logical-thinking of review protocol is developed and how the researchers should work and interact to conduct the review is decided. This protocol defines the procedure for choosing the suitable resources (paper, books, etc) and includes main problem, data collection form and methods of analysis. The second phase focuses on creating model based on the planning process. Finally, the purpose of the last phase is to elaborate the final report. The main purpose of our work is to design a model how MOOCs can offer an alternative distance learning model to optimize science centers in Indonesia.

Results and Discussion

Science Centers in Indonesia

Indonesia as a country with a wealth of demographic and the area takes in more than 200 science centers spread from Sumatra to Papua island. Based on the data on Table 1 (see Appendix 1), the nation has 236 science centers (*data can be grown steadily*) that include: museums, cultural centers, zoos, and national park are not all known and used by the public. The most powerful reason is the lack of promotional activities undertaken by the relevant agencies of the tourism bureau. The science centers should be optimized as informal learning centers of science education both for students, teachers, researchers, or the public society as well as addressed by new journal above.

According to Lipardi (2013), science centers have developed extraordinary capacities in the field ofinformal education: the activities produced in their educational laboratories,due also to the Internet, make up an important part of the education offered by eachgood professor of sciences. Science centers have become strategic hubs, combiningschools, research centers, universities and scientists.Finally, science centers arebecoming more and more a tactical instrument used to strengthen the relationship and dialogue between science, society and the public opinion, continuallycontributing to the creation of a true scientific citizenship, indispensable forunderstanding the modern world.

The Description of four Dimensions of MOOCs

As described in introduction that MOOCs have four criteria: social networking, acknowledged expert, freely accessible resources, and self-organize participation. Table 2depicts the different dimensions of MOOCs related to this criteria.

APPENDIX 1

TABLE 1: DISTRIBUTION OF SCIENCE CENTERS IN INDONESIA*

No	*Region*	*Number of science centers*			
		Museums and cultural institutions	*Zoo*	*National Park*	*Total*
1	North Jakarta & Thousand islands	1		2	3
2	West Jakarta	4			4
3	Central Jakarta	19			19
4	East Jakarta	4			4
5	South Jakarta	10	1		11
6	Yogyakarta	31	1		32
7	Banten	1			1
8	West Java	22	1	2	25
9	Central Java	11		2	13
10	East Java	11	2	3	16
11	Bali	11	1	3	15
12	Nusa Tenggara	2			2
13	Aceh	3			3
14	North Sumatra	10	3		13
15	Riau and Riau Islands	8	3		11
16	West Sumatra	16	1		17
17	Bengkulu	2			2

TABLE 2: THE FOUR DIMENSIONS OF MOOCS

Dimension	*Definition*
M: massive, self-organize participation	The online course designed for large number of participants. The number of participants is larger than formal class room The course design is different with formal curriculum to build a learning community
O: open, freely accessible resources	Course can be accessed by anyone in everywhere as long as they have an internet connection. Open means freedom in place, space and time. Freely accessible resources mean open to everyone without entry qualifications.
O: online, social networking	All aspects of course are delivered online so the course accessible to all people without limitations.
C: course, acknowledged expert	The course need an expert to guide the course about informal science for promoting science centers. The course offers a full course experience including science content, educational information, facilitation interaction among participants, activities, assignments, tasks, feedback, non formal information, and syllabus. For the consideration science content can use the list in Figure 1.The type of materials may include audio, video, information text, schedule, simulation, animation, forums, blogs, games, etc.

In MOOCs, participants are provided with some feedback mechanism. Taking for example, automatically generated from quiz, peer feedback, or general feedback

from guidance-expert. In addition, the participant will give opportunity to get a certificate of completion.

Principles of Instruction about Science Centers Contents by Using MOOCs

Regarding the main role of emerging MOOCs was for promoting science centers, the course should be design by following the learning principles as well as formal instruction. Merrill (2013) proposed ten principles of instruction and some of them appropriate to informal science: problem-centred learning, activation, demonstration, apllication, integration, collective knowledge, collaboration, differentiation, authentic resources, and feedback. Margaryan, Bianco, & Littlejohn (2015) argued that the five first principles were the most supporting for instruction become succeed.However, in informal science education (such as science centers), the most six suitable for informal science were problem-centred learning, demonstration, collective knowledge, collaboration, authentic resources, and giving feedback.

In terms of *problem-centred learning*, learning is designed for learners to acquire skill in the context of real-world problems. Authentic Learning, Situated Learning, Problem-based Learning, and Expansive Learning are premised on the idea that humans learn better when they are engaged in solving problems than when they are presented with information they are required to memorise. *Second, demonstration*: learning is promoted when learners observe a demonstration of the skill to be learned. This principle highlights the importance of showing learners what they could do to apply the new information or skill in new situations rather than merely presenting them information about what to do. Then, for *collective knowledge*, learning is promoted when learners contribute to the collective knowledge. *Collaboration* means learning is promoted when learners collaborate with others. *Authentic resources* means learning is promoted when learning resources are drawn from real-world settings. Finally, *feedback*: learning is promoted when learners are given expert feedback on their performance and contribution.

Model for Communicating Informal Science Education in Indonesia

In terms of MOOCs for communicating informal science education, to give a good online courses to students or public (citizen), the lecturer/ expert become the most important variable in online course retention and has the largest positive impact on the probability of a student or a public to successfully complete a course (Panagioti, 2013). Thus, a competent and motivated lecturer is needed to conduct online courses material. And, since the online course don't included in the semester credit, participant's motivation become a important part as they want to learn something in online courses. So, the technical problem faced by student shouldn't be occur because the more the students/ citizens motivated, the more they want to mastery

and learn how to use online courses. The orientation for promoting science centers is make public understanding of science so the place like science museums, zoos, national parks become popular and meaningful for public. Thus, the model for communicating an informal science centers must consider the potential opportunities that may be announced or activities transferred to the public by using the course via MOOCs as shown as in Figure 1.

Conclusion

Based on the four criteria of MOOCs: self-organize participation (massive), freely accessible resources (open), social networking (online), and acknowledged expert (courses), then the most six suitable for informal science wereproblem-centred learning, demonstration, collective knowledge, collaboration, authentic resources, and giving feedback. In addition, by considering the huge number of science centers in Indonesia (about 236), including: museums, cultural centers, zoos, and national park, so the role of MOOCs in promoting science centersin Indonesia are required.

The orientation of promoting science centers is make public understanding of science (PUS) and enact them become popular and meaningful for public. Model for communicating an informal science centers must deliberate the essence of science content that may be informed or activities will be transferred to the public by using MOOCs.Open Online Courses require individual learners to self-regulate

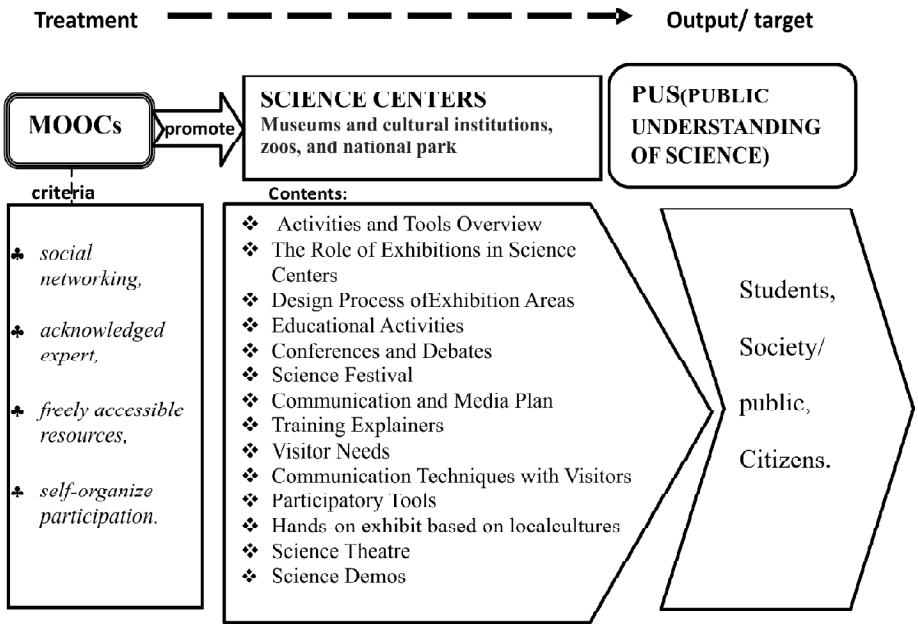

Figure 1: Model for Communicating Informal Science Education in Indonesia by using MOOCs

their own learning, determining when, how and with what content and activities they engage. Therefore, the self-directed, non-linear nature of learning engagement in MOOCs, which requires individuals to determine and structure their learning largely independently, combined with the diverse range of learners MOOCs attract, makes the instruction particularly meaningful (Hood, Littlejohn,& Milligan, 2015).

Since MOOCs operate as non-formal learning activities (Gillani & Eynon, 2014) then the relationship between public' context (learner's context) and role and their ability to self-regulate their learning has important implications for the structure and operation of MOOCs. An individual's self-regulation of learning is not static but may vary depending on the learning context. In terms of social networking, recent study by Chen & Chen (2015) provided evidence that study group may serve as an ideal approach to help MOOC learners develop requisite skills, share feelings and thoughts, and strengthen their self-determination to continue. We hope that this study will shed light on future design and implementation of MOOC study groups in informal science education, as well as inspiring more research in this direction.

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