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TEACHING URBAN RESILIENCE THROUGH COLLABORATIVE CONSTRUCTION: EXPERIENCE OF ODENSE 3 PROJECT IN JAPAN

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ABSTRACT

Indonesia and Japan share at least two similarities in terms of physical characters. Both countries are archipelagos and they are located within the so-called ring of fire network, which is prone to volcanic eruption and earthquake. The 2004 earthquake followed by a giant tsunami that killed more than 200,000 people in Aceh is a clear Indonesian example. Similarly, the 2011 earthquake and tsunami in North Japan had severely devastated several cities including the nuclear plant in Fukushima, killing about 15,000 and displaced more than 120,000 people - the worst nuclear disaster after Chernobyl in 1986. All of these examples have been responded by each country by paying more attention to disaster preparedness, ranging from doing advancement of building construction to creating a better awareness of disaster impact through education. This paper aims to describe the process of collaborative teaching on disaster preparedness between schools of architecture from four universities: Ritsumeikan University, Osaka Sangyo University, Laos National University, and Universitas Islam Indonesia. The main media of teaching was collaborative construction of a community hall on a reconstruction site of tsunami-affected settlement in Miyako City, Iwate Prefecture. Furthermore, the main question this paper intends to respond is, to what extend the project contributes to the creation of students' awareness of community's resilience in coping with the disaster? In response to such question, the paper reviews the whole project from its inception to the finalization of Odense 3 dome construction. The result of this project can be seen from two perspectives, i.e., teacher and student. The former is extracted from the process of selecting and coaching the students, while the latter is based on students' feedback noted during and after the program.

Keywords: Collaborative Construction; Disaster Preparedness; Urban Resilience

1. INTRODUCTION

The word 'resilience' in dictionary refers to the ability of people to feel better quickly after unpleasant situation, such as shock and injury (Turnbull, 2010). In the discourse of disasters study, the term is often seen as "a way of understanding the ability of a system to avoid damage as a result of a natural hazard impact" (Johnson and Blackburn, 2014:29). Therefore, urban resilience can be seen as the ability of a city to prepare and react to natural disaster in order to avoid (further) catastrophe. The earthquake and tsunami that hit North Japan in 2011 give a lesson on urban resilience, which is seen from the way the residents responded collectively during and after the event of disaster.

Although Japan and Indonesia share similarities in terms of disaster proneness, the author's empirical observation suggests that Japan has more robust system in disaster

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mitigation. One of the examples is the integration of disaster preparedness in secondary education through peer-to-peer learning of coping with the event of disaster, particularly earthquake and tsunami. Another example, which we found in the heritage area in Kyoto, is a community-based disaster mitigation through the formation of community "fire-brigade", who can quickly respond to any fire accident in the high density settlements of Kyoto's fire-prone heritage area.

The paper looks at how the above examples are integrated in a model of teaching that combines sharing of experiences, observation of existing condition of the disaster-affected areas, and hands-on learning of collaborative construction of a community hall called Odense 3 Dome (see Figure 1), conducted by students of four universities: Ritsumeikan University (RU), Osaka Sangyo University (OSU), National University of Laos (NUOL), and Universitas Islam Indonesia (UII). Even though the teaching approach is seen as a pilot project in architectural education, the author argues that the model fits to the curriculum of architectural education in the disaster-prone countries.

Figure 1 The final stage of Odense 3 dome construction

2. METHOD: NARRATING COLLABORATIVE CONSTRUCTION AND CROSS CULTURAL EXPERIENCE

The paper employed descriptive method, using semi auto-ethnographic notes of observation on the process of developing the training approach, from the selection of students to the implementation of the key activity, i.e. the collaborative construction of Odense Dome. Auto-ethnography is the use of personal experience as a way of research, as described by Ellis et al (2011:1):

> Auto-ethnography is an approach to research and writing that seeks to describe and systematically analyze personal experience in order to understand cultural experience.

The personal experience mentioned above is related to the author's position as a "*sensei*" (a Japanese term of "teacher") in the program. The role of *sensei* in this program was to coordinate the selection process of students in each university, which

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was the first step of the process. Each sensei who represented his[†] university was responsible to select and propose the students to be the active participants of the training.

The second stage was to design the teaching material, which was the responsibility of RU in collaboration with OSU. RU was responsible for the design of the dome, while OSU contributed to the structural calculation of the dome[‡].

The third stage was peer pre-construction training, conducted at Rits Campus in Shiga. The objective of this peer-training method was to allow Japanese students, who had been trained prior to the commencement of the program, to transfer their knowledge and skills to the 'guest' students from NUOLand UII (Figure 2).

Figure 2 Peer pre-construction training at Ritsumeikan University Campus

Furthermore, through observation and lecture, students were introduced to the culture of architectural production in Japan, from traditional to modern buildings. Lecture on disaster mitigation at RU headquarters in Kyoto was also a part of this fourth stage, which included a visit to Kyoto's heritage settlements, to observe the community-based fire protection system.

The fifth stage was the core element of the program, i.e. the construction of Odense Dome. The site for the dome is located in Taro District of Miyako City, Iwate Prefecture (Figure 3). The government of Taro allocated a part of the master-plan for roadside bus station project. Finally, the last stage was an evaluation of the whole process through the author's personal notes, in addition to photographs and videos uploaded by these students on the internet.

[‡] The dome was designed by Professor Shinsaku Munemoto of Ritsumeikan University, while Mr. Takashi Manda of Osaka Sangyo University was responsible for the structural engineering.

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Figure 3 Position of Miyako City in Japan where the site of Odense dome is located (source: www.seanpaune.com, accessed on 10 September 2016, reworked by the author)

3. RESULTS: TEACHING AND LEARNING PROCESS

As described in the preceding section, the descriptive method was employed in the research, conducted by using semi auto-ethnography approach through the narration of the author's notes on teaching and learning process. Therefore, the stages described in the preceding section are elaborated as follows:

3.1. Selection of participants and design of teaching material

While the program incorporated four universities, the author's role in the selection process was limited only for UII students. RU as the host of the program and the main channel for the funding decided the quota for students participating in the program as seen in Table 1. Therefore, the author decided to conduct an open recruitment at the Department of Architecture UII, using the following criteria:

1. Applicant must be an architecture student of UII who has passed Architectural Design Studio 6 – a mandatory core design subject for the third year student.
2. Applicant must have a minimum cumulative GPA equal to 3.00 (in 4.00 scale)
3. Applicant must have a good command in English, both oral and written (a portfolio and expression of interest written in English must be submitted as a part of the application)
4. Applicant with no international travel experience, especially to Japan, is preferred
5. Applicant must be independent and mature, and have a great interest in intercultural learning
6. Applicant must be in a good health as the activities will be mostly conducted outdoor, with long hours of physical movement

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The number of applicants from UII, in fact, reached 15, but the author could only choose three of them in order to meet the quota set by RU. Table 1 shows the composition of the participants representing each institution.

Table 1. Composition of participants

Institution	Male	Female	Sub Total
Ritsumeikan University (RU)	7	5	12
Osaka Sangyo University (OSU)	3	0	3
National University of Laos (NUOL)	5	2	7
Universitas Islam Indonesia (UII)	2	1	3
		Total	**25**

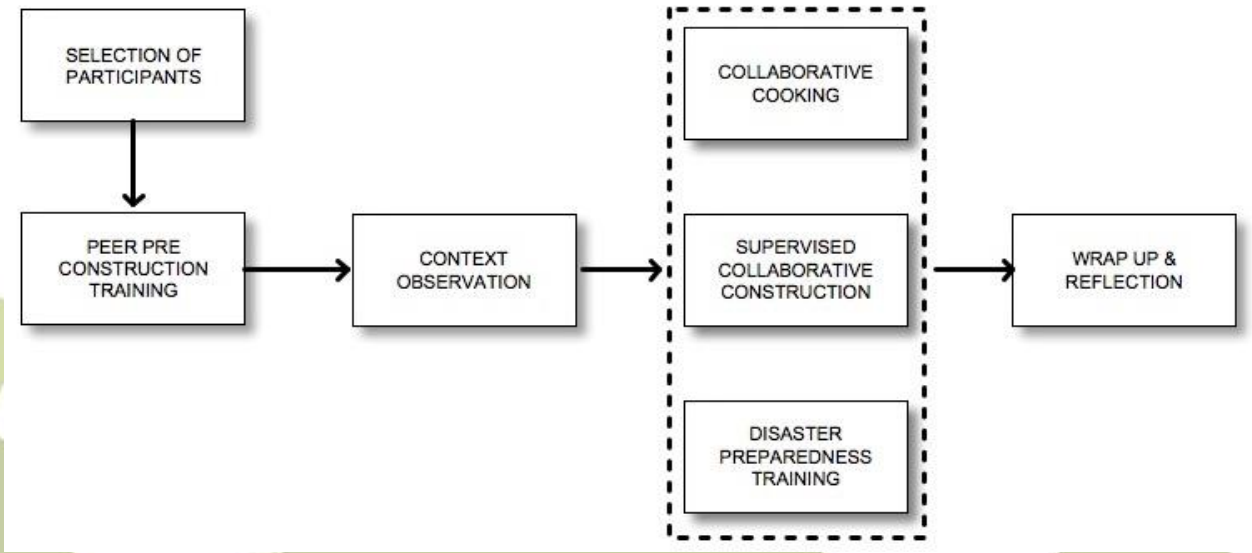

Figure 4 Teaching process (based on the author's note)

The teaching material was prepared by RU based on their previous experience in conducting a similar project in different locations, including in Vientiane, Laos. The architecture of Odense dome (refer to Figure 1) was designed by Professor Shinsaku Munemoto of RU, with the structural calculation prepared by Mr. Takashi Manda of OSU. As mentioned earlier, the process of dome construction became the core activity of the training, which is described further in Section 3.5. Overall, the plan of the teaching process can be described in Figure 4.

3.2. Peer pre-construction training

The peer pre-construction training, as seen in Figure 2 and 5, was conducted at RU Campus for one full day. The objective of such hands-on experience was to familiarize the participants in handling the process of construction. A team of students from RU, who were also a part of the RU participants depicted in Table 1, coached the NUOL and UII participants. The coaching began with an explanation of the dome design, followed by some exercises on using the construction tools, measuring and cutting the wood, as well as assembling the building parts. The students also observed the 3D model of the dome to get the idea of the whole building form (Figure 6). This observation was

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conducted at Munemoto's office of architectural design consultant, which allowed these students to experience the environment of an architect's office in Japan.

Figure 5 An exercise of moving a part of the dome element

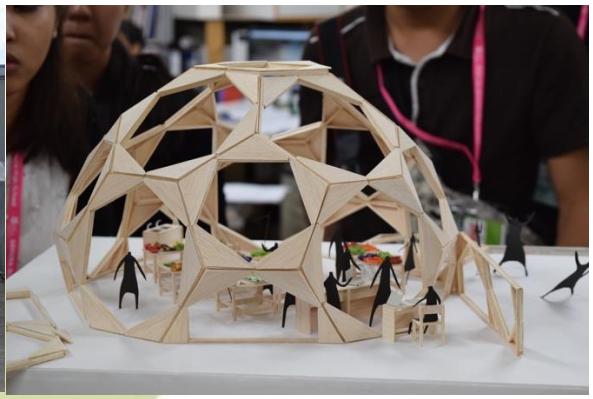

Figure 6 Odense dome model

3.3. Context observation

The aim of this activity is to observe the context of building construction as part of disaster preparedness. While the pre-construction is aimed at understanding the process of building construction, context observation looks at the culture of building that embodies the practice of construction in Japan, in addition to the Japanese resilience in coping with the disaster. The range of activity was from observing cases at country's level to familiarizing with the local environment around the site of the dome. An example of a case observed, which can be regarded as a way of disaster preparedness, is the fire safety management for heritage buildings and seawall to protect the settlements from tsunami, as seen in Figure 7 and 8.

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Figure 7 A community hydrant at a dense heritage area in Kyoto

Figure 8 (top and bottom) Seawall for a protection against tsunami

3.4. Collaborative construction

Collaborative construction is the core activity in the program where the students experienced the hands-on construction learning on site. As mentioned earlier, the site for the dome is located approximately 100 meters from the seawall within the site of roadside station (Figure 10), which at the time of our departure had not been constructed. The decision making in determining the location of the site was a part of the consensus between the local government of Taro district and Ritsumeikan University.

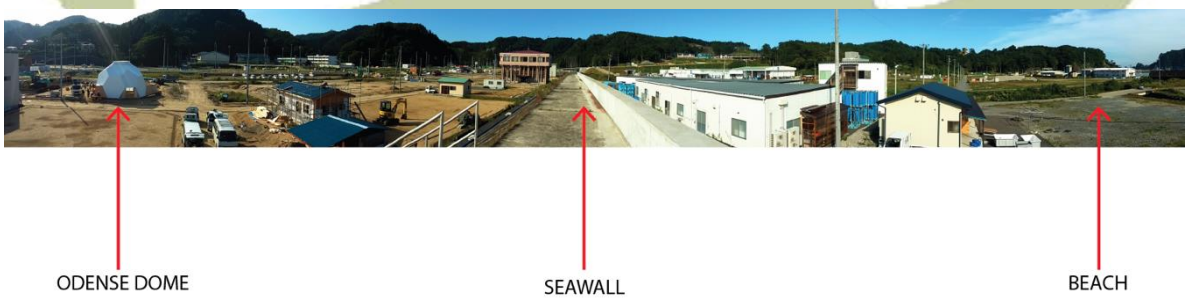

Figure 10 Position of the dome

The method employed in the process of construction was a combination of coaching and peer learning. RU appointed two construction experts to supervise and

assist the whole participants, while RU and OSU students who had been trained prior to this event were assigned to assist both Indonesian and Laotian students. In addition, some support persons were deployed to take care of the tasks beyond the capacity of the students, i.e. welding and operating the crane (Figure 12 and 13). The process of the collaborative construction is described in the following flow (Figure 11).

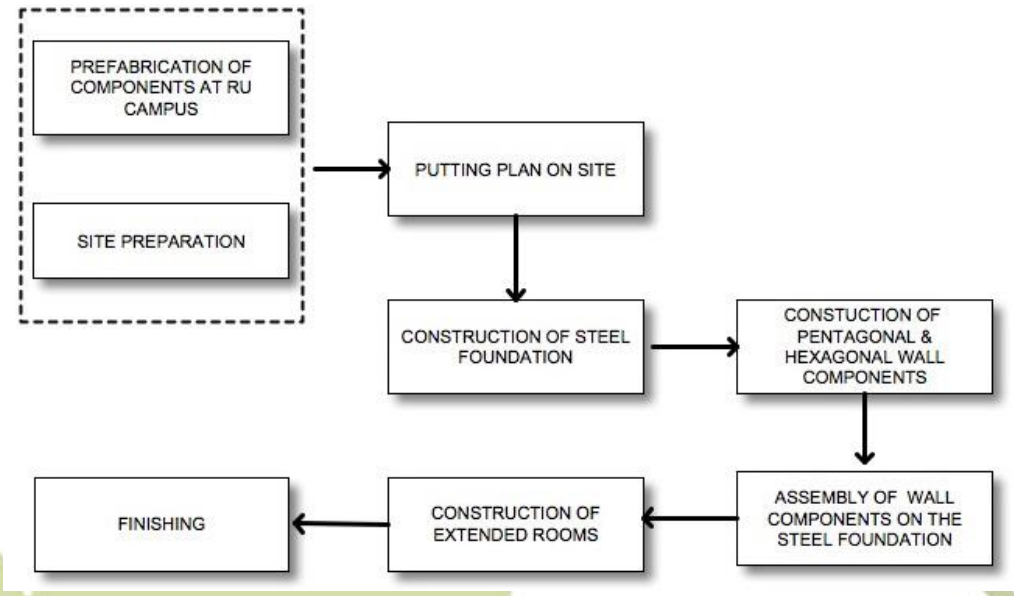

Figure 11 Flow of collaborative construction process

Figure 12 Welding the foundation components

Figure 13 Operating the mobile crane

As depicted in Figure 11, the first step is prefabrication of basic structural material for the dome building – the wooden beam. In order to allow faster construction process, these beams were pre-cut at RU campus, then transported to the site in Miyako City, which is approximately 1,000 km away from the campus. Meanwhile, the site preparation was conducted with the assistance of the local government of Taro. Upon the arrival of the participants, the work began by measuring the site to put the plan on site, followed by the construction of steel foundation (Figure 12) and pentagonal and hexagonal wall frames (Figure 14). During this stage, we experienced occasional rain

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that slowed down the progress. Therefore, the team decided to use a sport hall near our accommodation to complete the assembly process (Figure 15).

Figure 14 Construction of pentagonal and hexagonal wall frames

Figure 15 Indoor assembly activities

Upon the completion of the wall frames, the next step was to install the plastic sheet across each frame (Figure 16), then to assembly all the pentagonal and hexagonal wall components on the steel foundation (Figure 17). The process was quite challenging due to unexpected rainfall and some construction errors that slowed down the process. However, the team was able to overcome the obstacles in assembling the main part of the dome. As a part of the local tradition, the team celebrated the achievement with the local community (Figure 18), who also offered prayer led by a local leader.

Figure 16 Installation of plastic sheet into each wall frame

Figure 17 Assembly of wall components on the steel foundation

Figure 18 Celebration of achievement with the local community

Figure 19 Construction of extended room

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The next stage was the assembly of the wall frames and cover sheets for the extended room (Figure 19). The room is intended to allow the need of storage when the building is operated. The last stage of the construction was the finishing of the wall assembly where the team painted the foundation and cut any excessive sheets that covered the wall frames. Even though the author named such last stage as "finishing" (refer to Figure 11), the actual achievement was not 100 percent because the floor had not been installed when the Indonesian and Laotian teams dispersed at the end of the program. This task was then handled by the Japanese team.

3.5. Collaborative cooking and disaster preparedness training

Figure 4 shows that the core activity, i.e. collaborative construction, is parallel to two other activities, namely collaborative cooking and disaster preparedness training. Collaborative cooking is an activity where the participants (including the *senseis*) were grouped into several teams who were responsible for preparing the breakfast and dinner during the construction activity (Figure 20). Disaster preparedness training is a session where the participants were introduced to the experience of the local residents on how to save themselves in the event of earthquake and tsunami. The case depicted in Figure 21 shows a simulation prepared by the students of a vocational school, which won a national competition on disaster preparedness.

Figure 20 Collaborative cooking: breakfast prepared by students and *senseis* in a communal kitchen

Figure 21 Disaster preparedness: A demonstration of tsunami event by students of a vocational school in Taro District

Another important issue discussed in the training was the way of escaping from tsunami, where people were told to run as fast as possible to a higher place. Helping others during this situation should be avoided because it may cause more people to be injured or killed. In addition, the training also shows the participants the standard construction of public building in Japan, which is geared towards the protection against severe earthquake (Figure 22).

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Figure 22 Steel frame bracket of a school building for structural stabilization

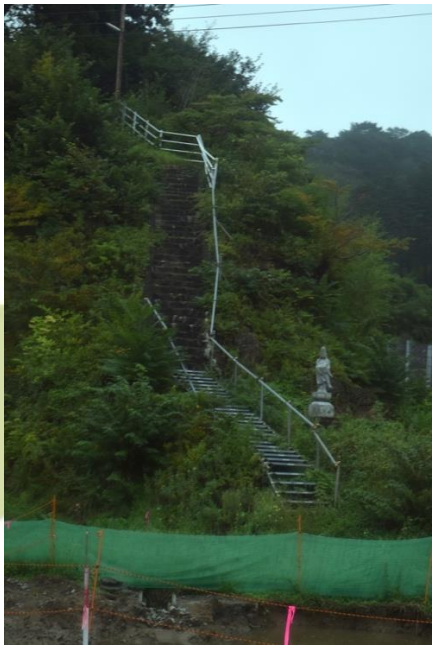

Figure 23 Escape stairs toward the top of the hill

3.6. Wrap up and reflection

The wrap up was a personal session where each participant gave a testimony on the lesson he or she learnt during the program, recorded collectively in a video format, shared on Youtube®. The sharing of the reflections through Youtube® was done because all the Indonesian and Laotian participants had already returned home at the end of the construction stage. Based on the author's examination on these testimonies, all of the participants from both Indonesia and Laos generally thought that the program is useful, not only in terms of learning the new construction techniques, but also in terms of opening an opportunity of future collaboration and networking within the Asian context. However, according to the author's note, there were some concerns on the way the tasks were distributed to the students during the construction. Some students occasionally expressed their confusion when they did not know what to do because they did not receive any instruction. This situation occurred mainly due to a communication gap between the students and construction supervisors.

4. DISCUSSION AND CONCLUSION

The flow of teaching and learning process in Odense 3 Project has taught us a lesson that disaster preparedness is a complex system, which requires an integration of multi stakeholder of development. It is not only about how people evacuate themselves in time of disaster, but also about making these people aware of what they have to prepare during the normal situation. It can be summarized from the preceding sections that disaster preparedness at least consists of two important activities: educating people and preparing a system that enables people to minimize the impact of disaster.

The construction of Odense 3 dome was meant to show the students how the laymen can actually build a shelter for the victims of disaster in a relatively short time, which is an imperative strategy needed in time of disaster. Therefore, the role of construction expert is important to scale up the capacity of students who often do not have construction skill at all. However, in the case of Odense 3 project, language barrier

was expressed by non-Japanese students because they could not speak Japanese, while the construction experts could not speak English. The Japanese students were asked to mediate communication, but they could not fully perform the task because they were also involved in the construction process. This situation contributed to the occasional idleness experienced by some participants from both Indonesia and Laos, which could actually be avoided if the participants knew what to do.

Getting to know the way the local people practice the disaster preparedness is also a part of the lesson learnt. Through the observation of the environment, the students were aware that the campaign of evacuation has become a part of everyday life. For instance, the instruction to run away from the sea without helping others in the event of tsunami has become a norm. This strategy is supported by infrastructure design, such as the path that lead to the stairs along the slope of the hill (Figure 23), and the tsunami warning sound system that can be heard around the city.

In addition to the above infrastructure development for disaster mitigation, our urban observation shows that Taro District has developed an alternative independent power supply, using solar panel. The government of such remote area learnt from the 2011 disaster, which could not be well anticipated because the electrical power supply was down due to earthquake. It caused the camera for tsunami monitoring to fail to work. As a result, the coming of giant wave could not be anticipated by the residents of Taro.

All the above stories reveal a lesson of resilience, the capacity of a community to move back to a better situation after the event of disaster; a lesson that can only be understood through a direct observation of the affected area, including communicating with the affected people.

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