APRC SL

by Ekadewi Handoyo

The Impact of Service Learning at Kebontunggul Village for The Students of Heat Transfer Class

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Abstract. Service learning is new for engineering students in PCU. When heat transfer class was adopting service learning methode last year, a small survey was done to know the students' respond for this new methode. The survey was done via reflection they wrote in the end of the process. The students learn not only heat transfer itself, but they also learn how to apply it to an oven needed by a community in Kebontunggul, a small village in Mojokerto. The students in three groups visited the village, discussed with the villagers, and designed the oven used to dry crackers' paste made from corn, cassava, and rice flour. Once the design was ready, the students went to workshop to manufacture the ovens. The oven was tested before sent to the village. They learned that it was difficult to make those cheap crackers. They learned a lot from the villagers in social interpersonal, social intrapersonal, emotional, and cognitive process. They are thankful to God for their being and grateful for this Service Learning class. A student even wrote, "I had changed motivation from just pursuing grade to seriously helping villagers".

Keywords: Heat transfer class, Kebontunggul Village, simple drying technology.

1 Introduction

In general, students come to learn in a university with an expectation that once they graduate they could use their knowledge to help, bless others, and meet their own financial needs. Students are prepared not only in academic issue, but also in emotional and spiritual issue. Doing so, the students are expected to experience transformation during their study and be ready to be a young adult to begin a real life. Service learning is the practice of incorporating community service into the academic curriculum. It gives students opportunity to apply the knowledge and skills learned in classroom to real problems in a community.

Wang and Rodgers [1] did study to learn the impact of service-learning and social justice education on college students' cognitive development.They investigated six courses. The results are that service-learning courses in general had a positive impact on students'

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cognitive development, while service-learning courses with a social justice emphasis appeared to have more impact on students' cognitive development than those without a social justice emphasis.

Community service learning has grown on college campuses, in large part because at its core it promotes bringing together what has traditionally been seen as three discrete spheres of learning—the classroom, students affair units, and the greater communities being served [2]. An explanatory mixed-methods design was used to evaluate a service-learning model on academic learning, personal and interpersonal development, and community-engagement for 59 service-learning students. Two sections of the methods, i.e. one for the quantitative analysis and one for the qulitative analysis. The results wasthat students improve their academic learning and participation in service but reduce their interests in-social institutions, local politics, and communication with community recipients from the beginning to the end of the semester [3].

Deepening community engagement by making commitments to social justice explicit in practice is the work that higher education must do to fulfill its promise as transformative practice in higher education for community and students development. Critical service-learning that brings atttention to social change, works to redistribute power, and develops authentic relationships can support our community engagement efforts to realize more just relationships by empowering communities, educating students, and engaging all of us in work for a better world [4].

College students, 217 doing service-learning and 324 not, completed the Civic Attitudes and Skills Questionnaire (CASQ) at the beginning and end of a semester. Students who were doing service-learning showed increases over the semester in their plans for future civic action, assessments of their own interpersonal, problem-solving, and leadership skills and agreement with items emphasizing social factors. No differences were seen in students' diversity attitudes. Students engaged in service-learning showed greater satisfaction with their courses, reporting higher levels of learning about the academic field and the community that did students not participationg in service-learning. Among service-learning students, satisfaction with course aspects and with service contributions was related to social justice attitudes, appreciation of diversity, and plans for future civic action [5].

The effectiveness of a higher education service-learning project to increase students' civic and socially responsive knowledge and intentions was studied [6]. A pre-test and post-test assessment using multi-item scales were given to a class with service-learning component. The study'sresults demonstrated that significant variation in individual differences between time one and timetwo did exist. Particularly noteworthy was the finding that previous service-learning experience, outside the classroom setting, predicted the level of civic attitudes and predicted the level and change of civic action [6].

Meanwhile, South Pacific Engineers Association explained that improvement of economic efficiency needs technical capability to make good technology decisions. The risk of poor decisions increases when governments do not recognize the need for technical expertise or engineers [7]. This implies that engineering education shall be accompaniedwith social awareness. Having good social awareness will prepare the engineering students to be good leaders for Indonesia.

Bielefeldt and Pearce [8] reported that there are three types of engineering classes where SL could be implemented, i.e.: design class, experimental laboratorium courses, and analysis-based engineering science. Integration of SL into design courses appears the most common. SL projects are among many choices avaliable to students of selected as the topic for a particular section of the course.

Many engineering educators see SL as a way to enhance their programs by exposing students to engineering context while also giving them a chance to develop professional and interpersonal skills. These values are reflected in the AccreditationBoard for Engineering

and Technology (ABET) standards for engineering schools. For an engineering program to get accreditation, ABET requires that they "Demonstrate that their students attain the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context" [9].

Through service learning, students learn to care and to help a community with their knowledge and skill that they learned in the classroom. Students also learn how to communicate to others who might have less education to get information of their needs and the way they want their problems solved. Then, students have experience to learn how to provide solutions to real problems in the community. The communities get help and hopefully feel blessed by the students.

This great learning methode is not common in ME Dept of PCU. Previously, we gave short training of maintenance a motor cycle for some teenagers who are from orphanage or unemployed. It will be interesting if SL methode is adopted in other subject that involves design and manufacture. In the beginning of the semester, the villagers asked PCU if we can help them with some oven they need to dry their crackers. At that time, with God's help we had some funding from research that can be used to build the oven. So this Heat Transfer class adopted this SL methode. A small survey was conducted after the students experiencing this methode via reflection that they wrote. As Mechanical Engineering students, they learn how to design and build some useful equipments to meet human's needs and to increase communities' welfare. Doing so, we hope the communities get some economic benefit and social gap would be reduced and we take part in building a better world.

2 What student did

One class in Mechanical Engineering is Heat Transfer. The goal of this class is that students could design a heat exchanger. The students learn to apply the theory they learned in transfering heat from one fluid to another fluid by conduction, convection, and radiation. Designing a heat exchanger for real needs will be useful for the students before they graduate. It is a wonderful opportunity to hear that a community in Kebontunggul needs drying oven which is basically a heat exchanger.

Kebontunggul is a small village in Mojokerto and has plenty of agricultural product, such as paddy, sweet potato, cassava, and corn. These products can not be kept in a long time after the harvest. The farmers need to sell them as quick as they can. Unfortunately, the market can not take all the products at once or the price will be very low. If those raw products can be processed to other kind of foods, it will increase the products' economic value and save the farmers from wasting them. For example, rice flour, cassava or corn is crushed and mixed with outher ingredients to make some delicious and tasty crackers called Puli, Samiler or Tortilla, as shown in Figure 1.

The head of the village arranges some home industries to produce these crackers. Some workers handle the process from raw material. The process are peeling, cleaning, cutting, crushing, mixing with flour, water, and some seasoning. This cassava or corn paste is wet and need to be dried. Otherwise, it can not be sliced. The workers can dry them under the sunshine in open air or in a drying oven. When they dry the corn paste under the sun, its colour will be faded and not as yellow as when they use drying oven. Hot air is needed to draw moisture from the products in the drying oven.

There was a need of drying oven from community and there were students who have the knowledge to build the equipment. We combinee these two in service learning. The students went to the village and discussed with the villagers about the crackers' production and drying oven they need. Some questions they needed to ask to gain data to design and build oven were: what will be dried, what was the capacity of the oven, what was the

weight reduction after it was dried, what is the maximum temperature to prevent protein breakdown in it, what was the fuel that was available for them, what is the maximum space they have for the oven.

Fig. 1. Some agriculteral products processed to be crackers

Having the data needed, students started to design the oven. There were three groups with five to six students in each group. To ensure their design will work properly, they presented their design in class after three weeks they visited village. They built the oven with help of professional workshop for about 1.5 mo., as shown in Figure 2. Then, together we tried the oven to see if it worked well. Then, they sent the oven to the village and the villagers accept their oven joyfully.

Fig. 2. Three drying ovens built by the students for Kebontunggul communities.

3 Evaluation

The students had some interaction with the community (villagers) that has different background, different level education, and even different language. The villagers are mostly quite poor, lack of adequate education, and many of themcan only speak refined Javanese (Kromo Inggil). The students who are growing in city are seldom speaking in this type of Javanese. So, interaction with villagers made students learn to understand sublte Javaneese. It is good for the students as part of a rich-culture country. The students learn other important language needed in society in Java before they work. Language is very important to communicate with others. Fortunately, the villagers could speak Indonesian well.

The students learned how to behave when they came to village and communicated with the villagers. They learned to ask questions by themselves. Having this experience, the students were open to life in village. They could see some difficult situation (especially in

economic) in village which is part of this country. Life in village is almost the same everywhere, i.e.: simple and low cost, slow not in rush, and friendly to anybody.

This SL was done in a group. Each group had eight to nine students. They need to apppoint a group leader by themselves. Being a leader or a group team, they all learned to work together. The leader arranged the group's schedule of meeting inside the group or visiting the village, distributing the work, and discussing their design until result. Students who were not the leaders had to obey the schedule composed by their leader.

Through SL, the students learned leadership and working together in a group. From the villager's point of view: they were joyful to be visited and to be helped. They also accepted students who visited them, although they are different in skin color, background, education, and language. Fortunately, the villagers can speak Indonesia, the official language, well. So, they could communicate adequately. Some benefits for the villagers though this SL are: they could get ovens to help them drying the batter cracker, they get the know-how to maintain and use the drying oven, and they increase the economic value of harvest—give benefit economically.

The respond of the students doing this SL is taken from the reflection that the students wrote in the end of this SL class. From their reflection, SL methode in teaching-learning gives students some benefit that can not occur in a conventional class. Table 1 shows the major processes associated with Heat-Transfer-service-learning class. This table complies to Simon and Cleary [10]. The percentage shown is coming from the students' reflection.

Table 1. The major processes associated with Heat-Transfer-service-learning class.

%	Processes	Themes	tterns
70	Social–interpersonal	Academic learning	Better understanding or application ability
		Career development	Hands on experience; confirmation of career choice; competence
		Self-knowledge	Self-confidence, social competence, self-efficacy
		Impact of the program	An appreciation of different cultures
		Interpersonal skills	Sociocultural identification; role identification
		Community connections	Enhanced my beliefs in the good of others
		Problem solving	esign an oven needs careful thought
81	Social–intrapersonal	Academic learning	Understanding of the field/villagers' need
		Career development	Impact as future mechanical engineers
		Self-knowledge	Understanding the field/course
		Impact of the program	Helped the villagers; made a difference via an oven
		Interpersonal skills	Share mutual goals in group
		Community connections	Developed partnerships/relationships; civic engagement
		oblem solving	ilt an oven with fuel available in the village
75	Emotional	Academic learning	Empathy; compassion
		Career development	Passionate about being a good engineer
		Self-knowledge	Felt food about myself

Table 1. continue to the next page.

%	Processes	Themes	Patterns
		Impact of the program	Felt good to be appreciated by the villagers
		Interpersonal skills	The villagers felt so thankful to get the oven
		Community connections	It was a wonderful experience; I am thankful for this experience
		Problem solving	I am grateful for how much I have, but we need to create resources for them
83	Cognitive	Academic learning	Evaluation of skills and oven designed
		Career development	Respect for engineers
		Self-knowledge	Realized the type of person that I am; personal values
		Impact of the program	I can work in a diverse individuals
		Interpersonal skills	I have learned that I can work with anyone
		Community connections	Learned how to relate to the villagers and friends and deals with their characteristics
		Problem solving	SL creates useful equipments for others

There were 16 students in the class. The percentage for Social-Interpersonal process was the lowest, because there was one theme that none was experiencing this. That theme was Community Connection which pattern was "enhanced my beliefs in the good of others". This service-learning heat transfer class' target was helping communities in village Kebontunggul with equipments or technology they need to improve their economic condition. Other themes that had lower percentage in Social-Interpersonal process were Career Development (eight students) and Self-knowledge (six students). All students gave related reflection in other themes.

In Social-Intrapersonal process, the lowest response from the students came to Carrer-Development (seven students) followed by Interpersonal skills and Community connections (each got 10 students). Other theme were responsed well by all students. For Emotional process, nine students wrote that they learned to be empathy or compassion as their Academic Learning. Other nine students also reported that they felt good to be appreciated by the villagers as the Impact of the Program, and nine students learned their Interpersonal Skills when the villagers felt so thankful to get the oven. For other themes, all students gave good responses.

In Cognitive process, the lowest response was from Self-knowledge theme. Only six students said that they realized their type of person and wrote about their personal values in this SL. Other low response was in Career-development theme. Only seven students wrote that this SL gave them respect for engineers. For other themes, all students gave good response. All students passed this heat transfer class. The distribution of the final grade of this class was 13 % got A (two students), 38 % got B+ (six students),19 % got B (three students), 19 % got C+ (three students), and 13 % got C (two students). It was a great class.

Some of their reflections are: they learned that making crackers from corn or cassava or rice flour is not easy. The paste (before it is dried) is too sticky to be rolled or sheered. Some said that theyhad to be patient to listen and understand the villagers' complain and need for a drying oven for their paste crackers. Some wrote that they learn to communicate with villagers who are very different in education, background, or social life, but they notice the villagers are having simple life and friendly. Almost all of the students wrotethat

they are thankful to God for their being andgrateful for this SL class. A student even wrote, "I had changed motivation from just pursuing grade to seriously helping villagers". How great the impact and the change would be in this country if some students having the same thought. This SL class brings benefit not only for the students but for the villagers, too. Yet, it has some difficulties in Mechanical Engineering Department (ME). The curriculum of ME Dept prepare the students to design equipments needed by communities. To design is no cost, but to manufacture is very expensive and needs big funding especially with a high quality equipments.For the oven that is given to Kebontunggul village, it needed around Rp. 3 000 000 to Rp. 5 000 000 at 2016. To sustain this SL method study in ME, it is necessary to have funding resources. Some possible things are using the government of the village's funding or collecting funding from some alumni or industries. Each village has certain amount of funding from government to develop their village. The funding should be able to pay the manufacture cost to meet the village's need. Funding could be gathered from some alumni whose work in manufacturing field. They could use this opportunity to be a blessing for others especially the villagers. Other resources are from industries that should doCorporate Social Responsibility (CSR). The funding could help villagers getting the equipments they need and industries doing their CSR.

4 Conclusion

SL is a good and life-changing methode. From Table 1., it is shown that SL class gave students experience to apply their knowledge and learn social life from the villagers. Almost all of the students recommended that SL class be continued. They had special experience that only SL can bring. Yet, it has some difficulties in Mechanical Engineering Department (ME). A Mechanical Engineer usually designs and manufactures machine or equipments needed by communities. To design is no cost, but to manufacture is very expensive and needs big funding especially with a high quality equipments.Some possible funding resources are from government, some alumni or industries.

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