

A model for implementing the service-learning method through collaboration with three institutions: the university, the science park, and community enterprise

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Abstract

Learning via actual practice has become more significant in education. The service-learning method is a high-impact technique for students in which learning happens via service and reflection on real-world objectives. This technique however must overcome several obstacles, including time constraints, student receptivity, money constraints, and collaboration partners. This study then aims to present a model for applying the service-learning approach to education by implementing it to the senior project of students. This model requires effective partners. A science park is a major partner to connect university resources with enterprises or organizations outside the university. Therefore, the science park can be seen as a third partner in the model to fulfill a gap between university and company. Each stakeholder's involvement in the model is studied and articulated. The methodology is modified and assessed by incorporating it into two senior projects that primarily focus on community enterprise packaging and labeling designs. These initiatives come from two community enterprises that are science park customers. Stakeholders in the experiment with this model include six 4th year industrial engineering students, one adviser, teams from the scientific park, and teams from two community enterprises. Each stakeholder takes different responsibilities to support this project. The findings suggest that this learning paradigm benefits all stakeholders. Students get new skills, knowledge, and experience as a result of their practice. The project outcomes could meet the needs of community-based businesses. The adviser acquires up-to-date expertise and knowledge. The science park can support the university with both instructional and customer demands. As a consequence, this model might be a viable model for contemporary education that benefits all stakeholders, especially in developing nations where knowledge and technology should be transmitted to local regions and education promoted.

Keywords: *design education, case study, design learning, the service-learning approach, education cooperation*

1 Introduction

In comparison to the past, university education structures are altering. In universities, learning and instruction are not just centered on lecturers' theories; students have more opportunities to learn through actual practice and the world beyond the classroom. This approach has had a significant impact on contemporary research, prompting academics to focus more on the practical learning process, often known as active learning. Students get the opportunity to apply what they've learned in class to real-life situations, which is critical for many courses that focus on skills rather than information. A service-learning strategy is a teaching and learning technique that links academic curriculum with community problem-solving. Students can study academic content while also contributing to their communities with this technique. To make the experience meaningful and personal, this approach relies on student engagement and ownership. Students, faculty, and community partners interact to integrate and apply empirically-grounded knowledge in real-world situations to address community concerns and achieve educational goals via action and critical thought. However, this technique faces several obstacles, including a time-consuming, complex model, a lack of resources and funds, student responsiveness, and community partners (Bates, 2009). The preparation of students, instructors, and community partners can all influence whether or not the service-learning strategy is successful.

In terms of location, ownership, and governance, a science park, also known as a university research park, is an entity that supports and stimulates the growth of tenant enterprises and is affiliated with a university (McCarthy et al., 2018). This institution has unique characteristics, such as master-planned property and buildings primarily for private/public research and development facilities, high-tech and science-based businesses, and support services; contractual, formal, or operational relationships with one or more science or research institutions of higher education; and roles in promoting the university's research and development. In Thailand, scientific parks may be found in university locations around the country. Suranaree University of Technology's science park is one among them. In terms of the science park's goal, the researcher recognized the science park's critical role in supporting the university's service-learning strategy. As a result, the purpose of this article is to create, propose, and evaluate a model to support the university's service-learning approach by including a science park that serves as a link between the institution and community partners in the student's project. According to the researcher, this may be one of the feasible methods for supporting education and collaboration among various stakeholders.

2 Literature review

2.1 A service-learning approach and stakeholder collaboration

A service-learning method integrates theory and practice by allowing students to participate in an organized service activity that addresses community needs and then reflect on the experience in class to get a better knowledge of the course subject and a stronger sense of civic participation (Bringle, et al., 2006). Service-learning aims to strengthen students' connections with the community and provide motivation for their personal growth and social activity by allowing them to actively engage in solving real-world challenges and taking time for critical thought

(Leming, 2001). (Waldstein & Reiher, 2001). According to the National Youth Leadership Council in the United States (Reinders, 2016), all types of service-learning should meet specified quality standards, such as the significance of the service, its relationship to the curriculum, reflection, partnerships, and diversity. It should promote community members' understanding of diversity and mutual respect, and it should include both "service" and "learning" components (Chambers & Lavery, 2012). This method is extensively utilized in the United States, Canada, and Australia, although it is rarely mentioned in Germany, Australia, or Switzerland (Reinders, 2016). In Thailand, this technique is also taught in schools rather than universities (Vu, 2013; Chutrung et al., 2019). (Nuangchalerm, 2014). Some studies look at service learning from the standpoint of students (Resch, 2018), while others look at it from the perspective of teacher educators (Kohlmaier & Miklautsch, 2019). The majority of teachers are enthusiastic about teaching practice courses. Student ownership, response from students, funding for operating the project, duration time, and a depth of understanding of the service learning method from instructors and partners are all factors to consider before using this strategy in the teaching-learning course (Bates, 2009). Collaboration in education requires the involvement of partners or stakeholders. For the entrepreneurial university, partnerships with business and government are leveraged in order to contribute to a regional or national economic growth plan based on innovation (Branscomb et al., 1999). The university aims to transmit its technology and creativity to existing companies or technology parks, as well as to profit from the commercial and economic growth of academic ideas through spin-off enterprises or initiatives (Owen-Smith & Powell, 2004). Types of collaborative activities and networking that contribute to expediting local, regional, or global transformation processes should be responded in order to foster cross-sector and multi-stakeholder cooperation. These issues should be answered: what variables help or hinder their effective implementation, and what incentives and policies are needed to encourage multi-stakeholder collaboration (Yarime et al., 2012).

2.2 Science parks' educational concepts and roles

The primary goal of scientific parks is to deliver value-added services and boost the competitiveness of the region or the zone they serve, which is overseen by trained personnel. This area aims to foster a quality and innovation culture among its affiliated firms and knowledge-based institutions, facilitate knowledge and technology transfer from sources to enterprises and the marketplace, and actively encourage the formation of new and sustainable innovation-based businesses through incubation and spin-off procedures (Sanz, 2001). Most science parks are evaluated in terms of economic performance (Ferguson & Olofsson, 2004), inventive activities (Siegel et al., 2003), university expansion and profile (Colombo & Delmastro, 2002), patenting activity (Link & Scott, 2017), linkages between enterprises and public research organizations (Fukugawa, 2006), and information spillovers in order to determine their effectiveness (Albahari et al., 2013). Science parks are informal frameworks in which information spillovers between universities and enterprises may occur more freely, allowing for the expansion and transfer of technological knowledge (McAdam & McAdam, 2008). Formal agreements and informal iterations are two ways universities might disclose knowledge to corporations (Dez-Vial & Montoro-Sánchez, 2016). Universities also help universities expand and become more well-known by helping them improve the number of publications, patents, technology transfers, and graduate placements (Yang et al., 2009). Local

knowledge spillovers may assist various enterprises in scientific parks in different ways. It is determined by the kinds of connections and interactions that companies have with other agents, as well as the placement of each organization in the knowledge network and prospective absorptive aptitude (Tsai, 2001).

3 Research questions

Several sorts of studies have looked at the service-learning method and stakeholder collaboration. However, while the majority of them theoretically represent academic principles and procedures, how they are implemented in practice has not yet been thoroughly investigated. Most of the service-learning method and stakeholder collaboration are integrated in education directly to the researcher or lecturer. Most of stakeholders are able to support a funding for students to proceed the project especially in the industrialized countries. In the developing country, many stakeholders are community enterprises that require funding to proceed the product development project. Science parks in Thailand can support them with some funding and services. Moreover, they have experiences in business and customer communication. They, however, require a supporting from the university regarding the knowledge of researchers. Therefore, designing the model for implementing the service-learning method through collaboration from 3 stakeholders: university, the science park, and community enterprise are required. Three research questions as the following should be answered in order to build and assess the model and processes of stakeholder cooperation in the service-learning approach:

- 1) What are the responsibilities of stakeholders in the service-learning method (students, supervisors, science park team, and community enterprise team)?
- 2) What kind of courses or projects are appropriate for service-learning?
- 3) What are the outcomes and advantages for each stakeholder of the service-learning approach?

The answers from these questions can guide a new contemporary approach to pedagogical development in design education for a developing country that has a science park in a region.

4 Research methodology

This research is being carried out at the Suranaree University of Technology's surroundings. Participants, task, and time are three important variables to consider while developing a service-learning strategy. The researcher teaches six courses in the department of industrial engineering as a lecturer. These are 1) product design for manufacturing, 2) decision analysis, 3) probability and statistics, 4) packaging design and labeling, 5) expert systems, and 6) industrial robots and machine vision. Each course takes 11 weeks, which is insufficient time to complete the service-learning project. The researcher then concentrates on the fourth-year project. Before graduating, students are required to work on a final project for one year. Students must choose a supervisor and a topic based on their interests and the supervisors' abilities. Students must utilize all of their knowledge from their schooling to finish the project, even when the topic is centered on a specific area of interest. As a result, the senior project is an excellent course for implementing the service-learning model in terms of time and student responsiveness.

The researcher consulted the director of the science park about tasks and the third party in this project after determining the groups of students and the course for using the service-learning application in education. The packaging design and labeling project is one potential for a task in this project. After producing a product and preparing to debut it on the market, many

customers in the science park require packaging and labeling services. The majority of the products are from community enterprises that are dedicated to improving and adding value to their local products. One of the Thai government's aims is to enhance the well-being of local societies via their revenue. This group of customers arrives at the science park through the innovation incubator platform. This platform's staff analyzes the customer's needs and looks for researchers at the university who can help them or combine with other platforms in the science park. As a result, the community enterprise is the model's third partner.

4.1 Analyzing stakeholder roles and relationships from three institutions in the service-learning approach model

The roles of stakeholders in the final project are studied and determined using the service-learning method, as shown in Figure 1.

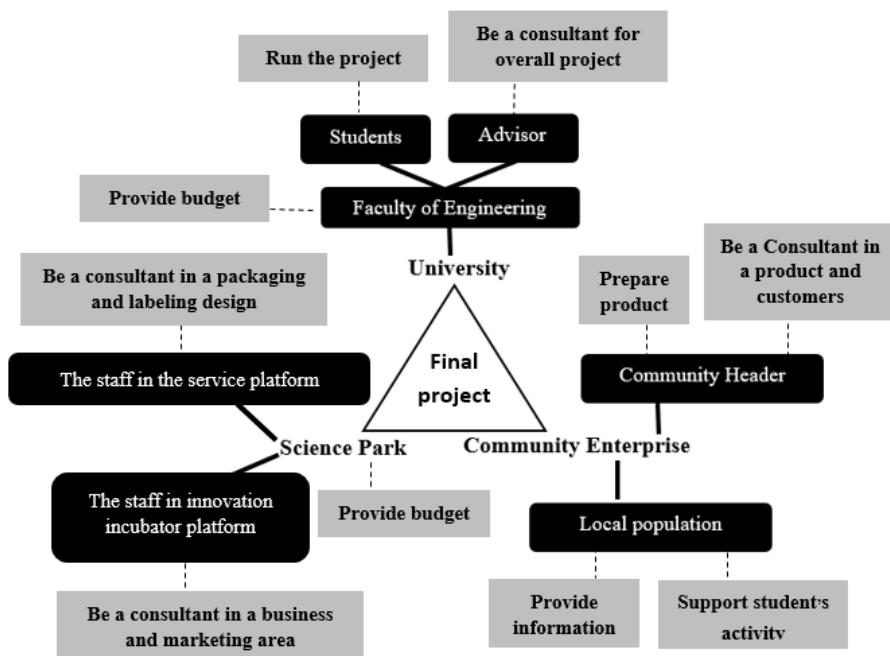


Figure 1. The model for a collaborative service-learning approach involving stakeholders

University: In terms of the researcher's background, the faculty of engineering is depicted. Students are usually given a budget by the faculty to complete the final assignment. As a result, students will have a small budget to work with for their final project. Students in the final project are fourth-year industrial engineering students who choose the researcher as their project adviser. They are in charge of overseeing the completion of the project. In this project, the advisor is the researcher, who is in charge of supervising students throughout the project, beginning with the definition of the project, scope of work, and processes for completion.

Science Park: The science park has several platforms, including an innovation incubator, a service platform, an industrial and technology platform, and an intellectual property platform. The innovation incubator platform and the service platform, on the other hand, are the focal points of this paradigm. The first platform to connect with consumers is the innovation incubator platform. This platform's employees are in charge of analyzing consumers' needs and

connecting them to researchers or services in the science park. They also have marketing and business model experience. This will provide students with an excellent chance to acquire new knowledge from them. Customers can use the service platform to develop packaging, labeling, and logos. Their designs, on the other hand, are primarily graphical. Productivity, market, and transportation are not major considerations. As a result, the staff on this platform can assist students with design technologies. Another benefit of collaborating with the science park in a service-learning approach is the funding for operating the project. The Thai government has set aside funds to assist consumers at scientific parks in developing local goods and encouraging local wisdom. As a result, science parks in this model may be considered as a bridge that connects university resources with external consumers by supporting this link with service and funding. The lecturers do not need to find a customer or provide funds to conduct the service-learning technique on their own.

Community Enterprise: The science park serves a diverse range of consumers, including corporations, small businesses, students, and community-based organizations. Because their needs are frequently related to packaging and labeling design, this strategy focuses on community entrepreneurs. To promote local products and introduce to the market, many community companies in Thailand require expertise and technology. They can form a partnership with university academics and apply for government funding to develop their local communities and increase employment for their residents. Staff from the community enterprise must describe their project requirements, which include growing agricultural regions, producing new goods, enhancing manufacturing quality, and building market strategies. Furthermore, they must participate in specific activities with pupils in order to finish the project. In this paradigm, they can be viewed as both a customer and a stakeholder.

4.2 Participants and assignments

The researcher supervised six students who were interested in the issue of packaging design and labeling for their final project. These students have already completed the package and labeling design course and so have a basic understanding of the subject. The senior project, on the other hand, need more expertise. Students should use what they've learnt in many areas and courses since they were first-year students. They should have expertise in project management, economics, marketing, and production design, in addition to packaging and labeling procedures. They should not only design the packaging and labeling, but they should also comprehend first and second customers. Customers who ask us to develop packaging and labeling for their products are referred to as our first customers. The initial consumers in this programme are community enterprises. The customer who buys the product from the first customer is referred to as the second customer. Secondary customers should be understood by students in order to build products that fulfill market needs..

These students are divided into two groups and work with two clients from the scientific park's community enterprises. Our initiative is explained to them by the researchers and personnel at the scientific park, and they agree to participate in our projects to evaluate the model of the service-learning method. The first group produced the packaging and labeling for a community venture that sells goat dung fertilizer. Fertilizer is usually sold in sacks by community enterprises. They don't include any branding or design on the packaging. They mostly sell to residents in the area. The second group is working on a community enterprise that sells beef.

This group grows high-quality Wagyu cattle whose meat isn't well-known. The meat is sold in plastic wrap. Because Wagyu beef is a high-quality meat, the community enterprise expects it to increase in value. Students work on projects under the direction and guidance of a research adviser, science park employees, and community enterprise staff. In terms of information from community enterprises, there is a lack of clarity concerning secondary clients. As a result, students have to work with both the first and second consumers, beginning with constructing a survey to gather market research, assessing prior packaging and labeling designs, analyzing budget, locating additional information about the regulation, and testing marketing. They have eight months to finish the project.

5 Results and discussion

The results are provided in two parts: 1) the final project results, and 2) the benefits to stakeholders in different institutions.

5.1 Results of the senior project

Table 1 summarizes the project's activities and knowledge resources.

Table 1. The project's activities and knowledge resources

Activity	Fundamental Knowledge from		New knowledge from the project	
	The packaging design course	Other courses from the department	By self-learning	From advisors, science park and community enterprise teams
Design the project's activities and procedures				/
Plan the project timeline			/	/
Study and investigate relevant information for products such as product characteristic	/			
Design surveys (find customer's requirement, product testing,..)			/	/
Design and produce logo, packing, and labeling	/	/		
Analyze budget		/	/	
Analyze market and competitors	/		/	/
Study packaging regulation			/	

Through various activities, students have several opportunities to practice, develop, and apply their knowledge and abilities in order to accomplish the project. These activities include designing the project's actions and processes, organizing the project timetable, researching and examining relevant product information, creating various surveys to analyze consumer habits and marketing, designing and producing the logo, packaging, and labeling, assessing the budget, market, and rivals, and researching packaging regulations. Some activities, however, need extra knowledge that were not in the industrial engineering course. To develop new information for the project, self-learning and guidance from stakeholders (supervisor, team in scientific park, and teams in community enterprise) are essential.

Because the projects need a wide range of knowledge and abilities, stakeholders are responsible for mentoring and helping students in their areas of expertise. For example, because the

advisor has a strong background in research and academic understanding in the field of engineering, the advisor is in charge of the project's procedures, technical abilities, and overall project. The science park's teams have extensive marketing and communication experience. They can advise students on company plans, marketing strategies, budgeting, and customer communication. These recommendations are an additional advantage for students in education when cooperating with the Science Park. Without the cooperating with the Science Park, students will only apply the knowledge from class in their works. Moreover, staffs in Science Parks can support students during the project, which help the advisor to supervise students. Community enterprise teams provide information on the local culture, people, and environment. Their failures and successes might serve as learning opportunities for students. However, some information, such as packing regulations and prototyping, need further research on the part of students. They must self-learn new material, thus they must learn how to locate information outside of the classroom and how to solve problems when no answer is supplied. Figure 2 shows examples of the final packaging design solutions from two groups.



Figure 2. The results of the packaging designs in the projects from A) the first group and B) the second group

5.2 Benefits for stakeholders in different institutions

University: In this project, the university has established a reputation for assisting in the development and resolution of community problems, as well as promoting more collaboration across a variety of sectors, including the community and general entrepreneurs. Furthermore, the collaboration's expertise and outcomes improve research publications and patents, gaining it additional recognition in the academic community. **Students:** Students can use practice to improve their knowledge and abilities. They may see not just the information from one course, but also the integration of knowledge from several courses and topics, which is not normally seen in class. Students also have the chance to learn through experiences, which are lessons that cannot be learned in a classroom setting. Students who project based on genuine market challenges or requests, according to the study, are more purposeful in their work, and the project deliverables are also of excellent quality. After graduation, students are also more confident in their job. This project might also serve as a basis for students who want to establish their own enterprises. **Advisor:** The adviser has a strong probability of forming a network of people from various fields. The adviser also learns something new from the project's students as they do research and have a better understanding of the market's true demands and issues. This enables more relevant research to be conducted, increasing the possibility of information being put into commercial practice. It is not essential to recruit customers, and lecturers are not required to

locate customers or solve problems on their own; rather, they must choose to address problems for current science park consumers.

Science park: Science park provides a great possibility to promote university education as well as customers. One of the Thai government's goals is to establish a research park in Thailand. The university is a valuable source of information and technology that will aid in improving the quality of life of local residents, who are sometimes difficult to reach by the government. This project illustrates an alternative approach of connecting academic knowledge with the needs of persons outside the institution in the community.

Community enterprise: The outcomes of this project have a direct impact on community enterprises. The issues have been resolved, and the local community's quality of life has improved. People from the community can learn alongside students while working on a project since there are tasks that require both sides' involvement, such as questionnaire design and interviews. Furthermore, after completing the project, students must share their expertise and information with the community for future use.

6 Conclusion

The researcher designed a new model for a service-learning method in the student's project through collaboration between the university, science park, and community enterprise. The project should not be limited to the laboratory scale. Students should have the opportunity to work on real-world projects while being supervised by experts. Because they are driven by the importance of the outcome, students may learn and practice faster when they work on actual cases. The fourth-year students, on the other hand, should be considered as a possible group for working on the service-learning method since they have the necessary responsiveness and expertise. In terms of duration time and participant preparation, the senior project course is appropriate for this sort of learning strategy. Science park plays a critical role in supporting the service-learning model in education by offering expertise, real-world client requirements, and funding to complete the project. This model is benefit especially for a developing country that has many community enterprises. They have no knowledge and budget, so the science park is a good bridge to support community enterprises to develop their products and their life. Students can also learn how to communicate and cooperate with stakeholders. The limits of using the service-learning approach in education are reduced as a result of these components. This concept is beneficial not just to students, but also to all stakeholders. Students can use the genuine work to develop their abilities. This project's conclusion will be able to meet the needs of community-based businesses. The Science Park can help with education (students) as well as customer service (community enterprise). The benefit of this project is that it serves as an initial example of how to enhance people's quality of life in the community as well as the country's economic basis, especially in developing countries. However, there is a danger that the outcome will be of poor quality. Stakeholders' trustworthiness might be affected by good or negative results. As a result, it is critical to maintain control over the project's conclusion and to assist students in completing the project to a high standard. For the supervisor, teams at the scientific park, and teams from community enterprises or companies, this is a difficult task.

It is challenging for future research to create a project or model of the service-learning approach by integrating different departments or faculties into the project. Since students are at university, it will be beneficial for them to practice working with others who have varied levels of expertise.

Students can then select whether or not to alter their major or continue their studies. They'll be able to change their abilities to collaborate with others more effectively. This is similar to practicing before working in a real-world setting.

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