

**Problem and Project Based Learning in Sustainability  
Enterprise Management: Exploration of Student Cognitive  
and Affective Skills**

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Master of Business**

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**Problem and Project Based Learning in Sustainability  
Enterprise Management: Exploration of Student Cognitive  
and Affective Skills**

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## **ABSTRACT**

The purpose of this study was to conduct an evaluation of learning outcome from a sustainability course implementing problem and project based method. This study was addressing the effectiveness of problem and project based learning for sustainability in generating affective and cognitive outcome. A case study has been chosen as research methodology. By interviewing four students, two project guides and a tutor data were collected. Student's reflections documents were triangulated with interviews data to obtain a better result.

Through the data analysis result, there is interesting evidence showing that problem and project based learning is an effective pedagogy that could improve students attitude and motivation toward sustainability as well developing students' competency in sustainability management. Student interaction and discussion during learning process contribute to student behavior and skills development. Meanwhile factor such as skills or personality could provide negative and positive influence toward learning outcome. When group has diverse skill, it contribute to positive learning outcome, however if skill gaps exist in the group it will demotivated students.

Real-world project, tutor and external stakeholder contribute significantly for student attitude, motivation and skills development. By doing the real-world project under external stakeholder assistance, student gained higher motivation to learn and to know more about sustainability issues. Moreover student also able to develop practical skills which is not possible to acquire under the traditional teaching method in the class. Tutor role and program designed is very crucial in determining student attitude, motivation and skills in problem and project based learning method. Tutor scaffolding strategy and tutor personality are proven contribute to student attitude, motivation and sustainability skills development.

Keywords: Sustainability competency, problem based learning,

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Vidayana Soebagio

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# CHAPTER 1

## INTRODUCTION

### 1.1 Background

Sustainability is an integral part of business activities. Managers know that if their companies show more concern about the resources they use and be more socially responsible, they can create public trust. Winning trust develops better relationships with their stakeholders to obtain long-run profitability. This phenomenon is clearly stated by Toppinen and Hänninen (2013) in their study about the impact of a company sustainability strategy toward stakeholders. They wrote,

*Pursuit for corporate sustainability can be considered as one of the current megatrends behind a growing number of organizational and technological innovations. With the introduction of new green products or services, companies can more efficiently use a differentiation strategy towards environmentally conscious market segments or improve their customer loyalty and retention (p. 2).*

Interestingly, many big companies find it difficult to implement sustainability strategies (Faruk & Hoffmann, 2012; Fisher & Bonn, 2011; Frisk & Larson, 2011). Fisher argues that a main factor causing this difficulty is because managers and executives do not have adequate practical knowledge of sustainability (Fisher & Bonn, 2011). Therefore, they struggle to determine the urgency of sustainability cases, formulate relevant company strategies, as well as measure the sustainability performance of their organisations (Fisher & Bonn, 2011).

The failure to recognise sustainability-related risks and opportunities might be caused by a lack of knowledge and skills from the university to the business field and a mismatch between the knowledge delivered in higher education and its implementation (Frisk & Larson, 2011). Since the United Nations Conference on the Environment and Development was held in Rio de Janeiro, Brazil, in 1992, education is deemed as an important component to achieve a sustainable global plan called Agenda 21. However, Falloon (2013) as well as Frisk and Larson (2011) argue that the content of sustainability courses in higher education, specifically in business schools, is not completely aligned with major sustainability targets such as the Brundtland report (Brundtland, 1987) and Agenda 21. This mismatch potentially leads to discrepancies between knowledge and its application when students enter the workforce.

According to Moore (2005), traditional education systems are mainly based on lecturers to transfer knowledge and see the lecturer as a knowledge provider for the students. This method is still considered as a good pedagogy; however, it does not promote attitude or behaviour change, which is important in sustainability (Moore, 2005). This traditional system also concentrates on individual student development and puts an emphasis on personal competition (Moore, 2005). Within this traditional education system, the aim of education for sustainability is to develop professionals who are able to determine risks and provide corporate strategies that can address problems (Cortese, 2003).

However, a recent report published by the World Economic Forum (WEF, 2015) shows that current global risks have become interconnected. For example, a biodiversity risk cannot be isolated from a food or poverty risk, since the biodiversity issue will influence the world food reserves and also affect economic development. This interconnectedness creates a higher level of complexity (WEF, 2015). WEF (2015) stresses the importance of collaboration to handle the global environment and social risks. It is necessary to build the same perspective within all stakeholders toward the issue and agree on a collaborative action.

The global environment and social risks expose the whole society, including the business sector. To deal with these risks, the companies also have to work together with all stakeholders. Company sustainability officials / business leaders need to have skills to establish collaborations and conduct negotiations. Moreover, their behaviours, reputations, and personalities are also important success factors in the collaboration process.

These kinds of skills and attitudes are considered difficult to teach using a traditional pedagogy. Roome (2005) points out that the traditional education system for sustainability is incompetent in developing student skills to promote stakeholder negotiations. This indicates that the sustainability science taught in most higher education institutions does not meet the needs of business. It requires a paradigm shift towards collaborative learning (Moore, 2005; Cortese, 2003).

The role of higher education, specifically business schools, in sustainable development is to equip students with a set of competencies that enable them to make effective

business decisions which are aligned with the principles of sustainability (Falloon, 2013). Business schools have an obligation to provide qualified human resources capable to take sustainability initiatives in a business context (Falloon, 2013). Therefore, higher education institutions should be able to develop sustainability skills and knowledge that is transferable to business practitioners (Frisk & Larson, 2011).

However, not only from the perspective of a business but also from the students' point of view, sustainability courses are challenging and require more than knowledge. Based on Falloon's study (2013), students who took more than ten business courses perceived that they had not obtained sufficient sustainability competency. In contrast, students who took less than ten business courses perceived that they had developed sufficient sustainability competency (Falloon, 2013). This study illustrates that students who know more about business are less confident about their skills in the business sustainability area. Similarly, a study conducted by Benn and Dunphy found that students in an MBA program perceived that a sustainability course is complicated and challenging (Benn & Dunphy, 2009). Benn and Dunphy (2009) identified that there are a lot of obstacles to the successful delivery of a sustainability course including the students' attitudes toward sustainability.

Education for sustainability needs to alter people's knowledge, skills, and attitudes towards sustainability issues (United Nations, 1992). As the sustainability issue consists of a broad range of problems, it requires a positive attitude towards sustainability to provide solutions (Hansmann, 2010). Shephard et al., (2015) argue that sustainability competency should be supported by positive behaviour. In other words, sustainable development requires a behavioural shift to complement sustainability knowledge and skills (Shephard et al., 2015). Therefore, sustainability competency is knowledge plus skills plus the affective dimension, such as motivation and attitude (Shephard et al., 2015).

Studies about the interconnection between behaviour and cognition in the learning process have shown that students' behaviours as an affective component could determine a cognition learning outcome (Boyd, Dooley, & Felton, 2006). Motivated students tend to get better results in a particular learning process. Moreover, according to Shephard (2008), positive behaviour might be a driver for students to take action about sustainability. Thus, the big challenge for sustainability education is to develop

students' cognitive and affective (feeling and behaviour) skills simultaneously (Hansmann, 2010).

The goal to change the attitudes and motivations through higher education is challenging, both as a course objective and evaluation. To address this challenge, there is a growing call in higher education to deliver a sustainability course using a student-centred pedagogical approach such as problem and project based learning (Hansmann, 2010; Scholz, Lang, Wiek, Walter, & Stauffacher, 2006). These teaching methods are believed to have an innate capacity to develop student affective and cognitive skills toward sustainability (Brundiers & Wiek, 2013; Mandeville & Stoner, 2015; Savin-Baden & Wilkie, 2004). However, this impact has not been documented to date (Savery, 2015). Consequently, to answer the demand from the business field, there is a need to research this learning method. The current traditional evaluation methods are not designed to measure behavioural components; thus, they are considered unreliable for that purpose (Shephard, 2008). Therefore, it is suggested to do an in-depth examination of the learning outcomes of a sustainability course to explore how students obtain affective and cognitive skills through the learning activities set.

## **1.2 Statement of the Problem**

Attitude and motivation are parts of affective competencies in sustainability, and they are difficult to teach (Barth, Godemann, Rieckmann, & Stoltenberg, 2007). Assessing these objectives is also considered complicated and time consuming (Shephard, 2008). Therefore, although an affective outcome is very important for sustainability education, many education institutions do not include them in their learning process (Shephard, 2008). It is possible to deliver a sustainability course that allows students to acquire knowledge on sustainability topics without any intention to develop their attitudes toward sustainability (Shephard, 2008). However, this will create a vicious cycle: institutions will not create graduates with the necessary skills and attitudes towards sustainability, the graduates will be unable to sufficiently contribute to a company's sustainability related issues, and the business sector will continue to lag behind in sustainability achievement (Falloon, 2013). It is therefore important to conduct a detailed evaluation toward sustainability learning in order to see affective and cognitive aspects as a learning outcome as what the study described in this paper aims to achieve.

In semester two in 2015, AUT implemented a new pedagogical method for sustainability education, which is called problem and project based learning (PPBL). This method is based on student-centred learning and requires students to be actively engaged in the learning process. In this learning process, students work collaboratively with their peers to do a project with the assistance of a project guide who is a permanent employee of AUT and is tasked to execute various aspects of AUT's sustainability strategy. This method is considered suitable for sustainability learning because of its ability in altering students' knowledge, skills, and attitudes (Figueiró & Raufflet, 2015).

This study aims to contribute to understanding the effectiveness of sustainability learning in a business school. Therefore, the purpose of this exploratory study is to conduct an evaluation of learning outcomes from this new pedagogical approach.

The following research questions are addressed:

1. How effective is the PPBL method in developing students' attitudes, motivations, and skills toward sustainability?
  - How do group discussion and class feedback on projects contribute to students' attitudes, motivations, and skills towards sustainability?
  - How do external expertise and the project contribute to students' attitudes, motivations, and skills towards sustainability?
  - How does the tutor scaffolding method affect students' attitudes, motivations, and skills towards sustainability?
2. How valuable is the experience of being involved in a sustainability course for the external stakeholders?

### **1.3 Methodology**

This research employed a qualitative research method. The intention of this research is to explore students' attitudes, motivations, and cognitive skills toward sustainability resulting from a collaborative study and working on the project. Students' perceptions as well as the project guides and teachers' perceptions were used to observe students' achievements. This evaluation also used student reflections in order to identify students' attitudes, motivations, as well as cognitive skills toward sustainability.

### **1.4 Assumptions and Limitations**

Problem and project based learning is a complicated teaching method. There are myriad factors that could influence the results, including workload in other courses and other relevant skills, such as people and systems learning skills that are important to PPBL but not taught directly in the course that is being evaluated. These aspects are not studied in this thesis. Gathering data through interviews depends on the perception of students and the judgment of the tutor and project guides, and would ideally be done over more than one course. However, given the time frame of the study, this was not possible.

## **CHAPTER 2**

### **LITERATURE REVIEW**

The integration of corporate sustainability and company strategy is triggered by environmental and ecological trends which put both society and business in a vulnerable situation (Grossman, Erikson, & Patel, 2013). According to Grossman et al. (2013), neglecting these trends would drastically change business circumstances which are very expensive to overcome. Furthermore, companies also have to face moral pressure from society in order to use resources without negatively impacting future generations (D'Amato, Henderson, & Florence, 2009).

Nevertheless, developing a company's corporate sustainability strategy will need new technology, knowledge, and skills (Tsai, Tsai, & Chang, 2013). A company should be able to manage the three fundamental dimensions - environmental, social, and economical - properly and in balance. The needs for talented employees who can manage the three aspects can be catered for by higher education, including business studies. Falloon (2013) points out that the role of business schools is to develop students' sustainability skills that can be used to manage the negative impact of a company's operations toward social and environmental conditions.

Furthermore, a global concern regarding this issue has initiated a collaboration among business schools to create an organization called PRIME (Principle for Responsible Management Education). The members of PRIME are business schools around the globe who are concerned about the capacity of business leaders in managing company sustainability. To assist the transformation of business schools in producing graduate students with acceptable capabilities in sustainability, PRIME has developed six principles: to shape student sustainability capabilities, to integrate the values that benefit society into curricula, to develop effective learning methods to create ethical business leaders, to commit to advancing sustainability research, to work together with business practitioners, and to maintain stakeholders' communication channels (PRIME, 2016). However, in spite of the numerous indicators which point to the importance of sustainability education in business schools, the effectiveness of education for sustainability remains largely unanswered (Savery, 2015).

## **2.1 Education for Sustainability**

Traditional education systems for sustainability, according to Porter and Cordoba (2009), are mainly based on functionalist system thinking. From this perspective, issues are seen as a technical phenomenon. Therefore, solutions for sustainability issues might be mainly found in innovation. Students are taught to recognize and investigate the sources of problems and to measure the impact on organizational performance. Porter and Cordoba (2009) stated that the objective of education for sustainability under a traditional system is to measure the environmental impact and minimize this through technical solutions (Porter & Cordoba, 2009).

Sustainability education through this functionalist approach might provide a good outcome when students have to solve a problem which is already recognized or characterized (Porter & Cordoba, 2009). Students are usually capable of finding a solution to enhance or improve the process (Porter & Cordoba, 2009). Furthermore, Porter and Cordoba (2009) suggest that in business schools sustainability is usually introduced based on the organizational function. Study materials relate to a particular business functional level such as production, finance, or marketing. Increasingly, business students are also trained to understand the company's decision making process toward sustainability, often from a top to bottom or leadership approach (Porter & Cordoba, 2009). Students often learn these through case study analyses guided by lecturers.

### **2.1.1 Sustainability Competency**

Wiek, Withycombe, and Redman (2011) point out that the concept of competency in sustainability has been acknowledged in many different ways. According to Wiek et al. (2011), competency in sustainability is “a functionally linked complex combination of knowledge, skills, and attitudes that enable successful task performance and problem solving” (p. 204). This definition is slightly different from Chalkley (2006), who states that “higher education’s most valuable contribution to sustainability lies in providing large numbers of graduates with the knowledge, skills, and values that will enable businesses, the government, and society as a whole to progress towards more sustainable ways of living and working” (p. 235). Wiek et al. (2011) prefer to use attitude instead of Chalkley’s notion of values. Regardless of the differences between these two definitions, in a broad perspective, competency in sustainability can be seen

as a combination of cognitive (knowledge/skills) and affective (feelings and behaviours) dimensions.

Meanwhile, the term ‘competency’ can be defined as the ability to perform a particular task to obtain a desired result (Field, 2008). This definition implies that competency might be understood as knowledge and skills that can make a person constantly able to show a high standard of achievement in the work environment. Moreover, as has been described above, the underlying components for competency in sustainability are knowledge, skills, and values or attitudes (Wiek et al., 2011; Chalkley, 2006). Knowledge and skills are considered as part of the cognitive domain, while attitudes or values are considered as part of the affective learning domain. Therefore, sustainability education should view these components as learning objectives.

#### **2.1.1.1 Sustainability Knowledge**

Sustainability knowledge as the first component is about sustainability science. Pesonen (2003) points out that business school students are required to study natural and social sciences and their contributions to organizational performance. Moreover, according to Stubbs (2013), it is crucial to attain high levels of understanding related to sustainability theories or issues. Indeed, sustainability issues cover a wide range of subjects, including environmental and social subjects. Hence, being able to describe the situation related to a particular sustainability issue will need the ability to think systematically and critically.

#### **2.1.1.2 Sustainability Skills**

Sustainability skills, according to Stubbs (2013), are the ability of graduates to perform several activities which are needed in the process to find solutions. For example, particular sustainability issues undoubtedly will involve several stakeholders with different interests. Therefore, achieving a win-win solution for them requires extensive negotiations. As a result, having excellent communication and negotiation skills is essential for graduates. Moreover, Pesonen (2003) explains that business students who learn sustainability should have the necessary skills to recognize the influence of the natural and social environments on company performance and the impact of company operations on the natural and social environments.

#### **2.1.1.3 Sustainability Values/Attitudes**

The third component is sustainability values or attitudes. It is defined as favourable student perspectives of sustainability issues (Stubbs, 2013). The term ‘sustainability values’ can also be interpreted as a positive stance toward sustainability issues or toward the sustainability learning process. According to Shephard (2008), sustainability values might be seen as emotional and behavioural dimensions of learning or what Bloom called the affective domain. Chalkley (2006) and Shephard (2008) point out that education for sustainability should achieve an affective outcome. Emotional and behavioural dimensions have important roles to play in achieving an acceptable solution for a sustainability challenge. A highly motivated person will have the desire to be proactive with sustainable development, which means they will not give up if they have to face complicated issues (Hansmann, 2010). Moreover, becoming a company key driver in cultural transformation for a sustainability framework requires a person who is strongly motivated to implement sustainability (Stubbs, 2013).

Therefore, utilizing education for sustainability not only transforms students to become qualified persons who know how to manage sustainability problems, but it can produce individuals who have high motivation to bring about a positive attitude towards sustainability. Both the cognitive and affective domains in sustainability learning will be discussed in detail in the following sections.

### **2.1.2 Pedagogical Approach for Sustainability**

Benn and Dunphy (2009) indicate that sustainability education in business schools cannot develop graduate students who have competency in sustainability as demanded by the business sector. Frisk and Larson (2011) argue that the source of the problem is traditional pedagogy which tends to underestimate the complexity of sustainability issues and rely too much on personal effort to find the solution. Another critique toward traditional pedagogy for sustainability comes from Fien (1997), who stated that the current education methods neglect behavioural aspects in sustainability learning (Fien, 1997).

The objective of sustainability education in business schools, according to Shephard (2008) is to create students who have a higher degree of understanding about sustainability issues and a willingness to implement the skills that they have to take a sustainability initiative (Shephard, 2008). Furthermore, Shephard also mentions that the emotional (affective) dimension, such as attitude and motivation as a foundation of

sustainability behaviour, has to be set as an objective in education for sustainability (Shephard, 2008). According to Frisk and Larson, sustainability education should address: knowledge integration, thinking for the future, working together, and encouraging action (Frisk & Larson, 2011). Bamford (2015) stresses that sustainability education should address the behaviour domain in order to produce important knowledge that can enhance student competency in the sustainability area.

According to Barth et al. (2007), competency in sustainability is something that is not easy to obtain, because it consists of knowledge, skills, and attitudes as an education objective. Dawe, Jucker, and Martin (2005) further state that sustainability skills can be categorized as an extraordinary competency, and as a result, it will need a specific teaching and learning method. Therefore, the challenge for business schools with regards to the rapid changing current situation is the difficulty of determining the education method which is the most appropriate to teach both cognitive and affective skills (Dawe, et al., 2005).

Frisk and Larson's (2011) study regarding sustainability education transformation at business schools presented an integrated education approach. They propose a pedagogy which concentrates on competency development. Warburton (2003) points out that sustainability education needs an innovative method which is capable of integrating several different disciplines. Such sustainability education should implement a learning method which promotes deep learning (Warburton, 2003). The often suggested method to promote competencies of sustainability is a pedagogical approach based on real-world learning experiences such as problem based learning and project based learning methods (Brundiers, Wiek, & Redman, 2010). These methods are based on the constructivist learning theory which proposes that people develop their understandings from constructing knowledge through experiences (Brundiers & Wiek, 2013). The application of these methods in sustainability learning is considered relatively new. Therefore, it is crucial to investigate how students construct their sustainability knowledge and skills through this learning method.

### **2.1.3 Constructivist Theory of Learning**

A large number of studies in education and psychology employ the constructivist theory (Phillips, 1995). Constructivism is a theory grounded in psychology explaining the human learning mechanism. This theory argues that humans develop their knowledge

through doing activities, not by memorizing information (Phillips, 1995). Knowledge is constructed through a process of learning that gives an individual an opportunity to undertake activities independently (Morales, 2010). Knowledge construction happens when an individual internally tests and processes one's experiences and feelings about the world. This is the central idea of the constructivist pedagogy.

Although this theory is very well-known and widely accepted, scholars' understanding of constructivism varies great deal. It has been interpreted in several different ways (Phillips, 1995). It is generally agreed upon that humans learn by constructing knowledge, but how learners construct their knowledge is interpreted differently. One of the most influential constructivist theories is the one by Jean Piaget who argues that each individual has a dominant role in controlling the development process (Devries, 1999).

Where Piaget focuses on the role of the individual, Lev Vygotsky's theory of constructivism focuses on social cognitive development. Vygotsky believes that the external environment has a direct impact on the way a human thinks and how a human perceives the world (Devries, 1999). Vygotsky thinks that the interactions between the learner and the learner's external environment contributes significantly to individual knowledge development (Devries, 1999).

Constructivism after all is not a theory of teaching, but a theory of learning. It focuses on how humans develop their skills, either cognitive or affective. Student-centered learning aims to provide students with the experiences of real-world problems and promote collaborative learning, which is relevant with Vygotsky's constructivist theory (Brundiers & Wiek, 2013; Lehmann, Christensen, Du, & Thrane, 2008; Morales, 2010; Roy, Kihouza, Suhonen, Vesisenaho, & Tukiaianen, 2014). This research adopted constructivism as a framework to analyze students' learning processes. Through the project, the students learn in relation to the external AUT environment.

### **2.1.4 Constructivist Pedagogy**

Constructivist pedagogy is teaching and learning methods grounded in the constructivist theory of learning. It is believed that human knowledge development is highly dependent on the activities of each individual learner (Abdulwahed, Nagy, & Blanchard, 2008). Constructivist pedagogy proposes that students' enthusiasm is a crucial aspect in

the learning process (Morales, 2010). Therefore, the teaching strategy puts more emphasis on how to engage students to participate actively in the process than how conventional pedagogy does.

Problem based learning and project based learning are teaching strategies that can be considered as constructivist pedagogy (Abdulwahed et al., 2008; Brundiers & Wiek, 2013; Lehmann et al., 2008). In these teaching strategies, students have the flexibility to control their own learning and rely on group work to endorse collaborative learning (Applefield, Huber, & Moallem, 2000). Each individual student constructs one's own knowledge by sharing experiences and social interactions with peers. These methods engage students to actively solve problems in their own groups.

According to Hmelo-Silver (2004), teachers who use problem and project based methods have a different role compared to teachers who use traditional methods. Their main role is to provide some guidance for the students related to the course methodology and help students to manage their problems or projects. This includes facilitating group work and bridging the relationship between students and external stakeholders. The main objective in using problems or projects in a learning activity is to help students construct knowledge and transform the learning from a teacher-centered into a student-centered approach (Hmelo-Silver, 2004). Teachers do not have to provide information for the students, because students have to find their own information which is suitable to help them in solving the problem or project.

#### **2.1.4.1 Problem Based Learning**

Problem based learning is a constructivist pedagogical method which relies on the integration between mastery of theory and exercise (Savery, 2015). Initially, it was developed as an instructional method in health science when traditional teaching was deemed not suitable anymore for medical students to understand complex real problems (Savery, 2015). The main characteristic of problem based learning is group learning that works to solve a problem. Therefore, students are encouraged to apply their knowledge and skills to deal with problems they have to solve.

Several studies show that problem based learning has several benefits compared to traditional learning. Problem based learning is seen as being able to develop students' problem solving ability, improve their learning skills, and boost students' motivation

(Savin-Baden, 2000). A study by Hmelo-Silver (2004) shows that students in a problem based learning class can generate more precise hypotheses than students from traditional classes. It shows that problem based methods have the possibility to increase student understanding related to a particular topic. The use of real-world problems contributes to the development of research skills, because to solve a complex problem, students need to design and implement data gathering and analysis procedures (Savin-Baden, 2000).

Besides being beneficial to build cognitive skills, problem based learning can also develop other aspects which are related to human behaviour. The group activity in this method is also seen as a positive contributor to develop skills such as presentation and negotiation skills (Savin-Baden, 2000). A study on the effectiveness of problem based learning in a Biometric course for undergraduate students shows that the problem based method has a positive effect on students' attitudes toward learning (Mandeville & Stoner, 2015).

According to Jaimini (2010), in collaborative learning, students' knowledge development process occurs when students are engaged in interactions with other students. Therefore, it is crucial for teachers to support students to actively participate in group discussions. Moreover, Jaimini (2010) points out that group diversity such as being different in age, gender, and prior skills might contribute positively to students' knowledge development. How students interconnect with their peers in a group, according to Ryan & Deci (2000), also could influence their intrinsic motivation. If students feel that they get along with their peers in a group, it will develop their motivation. However, if they cannot get along in this situation, it will ruin their motivation.

In problem based learning, students start to build their knowledge through group discussions. According to Shephard (2008), group discussions can be used to develop students' attitudes and motivation besides enhancing their knowledge (Shephard, 2008). This idea is supported by Lu, Mundorf, Ye, & Shimoda (2015), who stated that group discussions allow students to share their information with their peers, and they might exchange information and opinions. Therefore, this process will bring out a higher level of thinking. It is also possible to develop student awareness and creativity. In a group discussion, students will learn how to ask, answer, start a conversation, and motivate their peers (Soller, 2001).

However, problem based learning has some obstacles, especially related to the complex nature of the method. To run smoothly, this method needs a lot of preparation, especially in designing the problem. The problem should have several characteristics: it has to be comprised of multiple explanations or facts of one problem (Helle, Tynjälä, & Olkinuora, 2006); it should not have a most right answer (Savin-Baden, 2000) or what is termed as “ill structure” (Hmelo-Silver, 2004); and it should have the possibility of multiple interpretations. Therefore, the kind of problem which is suitable for this method is not easily designed. According to Savin-Baden (2000), there are many educators who still cannot differentiate between problem based learning and problem solving learning in terms of the problems used in those methods (Savin-Baden, 2000).

In addition, instructors often do not take into account the students’ prior knowledge or lack of it; thus, some students find it difficult to deal with the learning process (Helle et al., 2006). Problem based learning is a typical learning approach which is based on group learning. Therefore, the learning results for each individual student are related to other individual skills in the group.

Problem based learning as a pedagogical method is believed to be an excellent teaching method and is gaining in popularity (Savery, 2015). Despite its popularity, the effectiveness of this method is still understudied (Savery, 2015). It is still difficult to prove that the problem based method contributes to constructing student knowledge, compared to traditional methods. The main issue is the complexity of this method. Tutors need to be well trained before they are able to function using a problem based method.

#### **2.1.4.2 Project Based Learning**

Another pedagogical approach which has been developed based on active learning and a collaborative learning strategy is project based learning. Project based learning is part of the constructivist pedagogy, which has similar characteristics of problem based methods, but uses a project as the medium to construct student knowledge instead of a problem. Project based learning requires students to learn by performing several activities to solve a complex problem collaboratively in order to generate a tangible outcome (Blumenfeld et al., 1991). The outcome in project based learning might be in the form of a particular program or actual product (artifact). Learning activities in

project based learning such as data collection, data analysis, or group discussion are set within a project framework (Savery, 2015). Accordingly, the project as a learning inquiry for the students is the central focus of this learning method.

As both project based and problem based learning are products of a constructivist pedagogy, they have a strong resemblance to each other. According to Brundiers and Wiek (2013), there are six shared components between problem based and project based learning: there is a real world problem; it is student-centered; it simulates a professional situation; it requires processing of multiple information sources; the teacher acts as a facilitator; and a performance based evaluation is employed. Those six items are fundamental components of a constructivist pedagogy which tend to blur the boundaries in the application of a problem or project based method (Brundiers & Wiek, 2013). However, the two methods also have key differences, which are: outcomes, activities, organizing principles, and self- learning direction. Those points potentially influence the strengths and weaknesses of each method. The diagram below sums up those characteristics of problem based and project based learning.

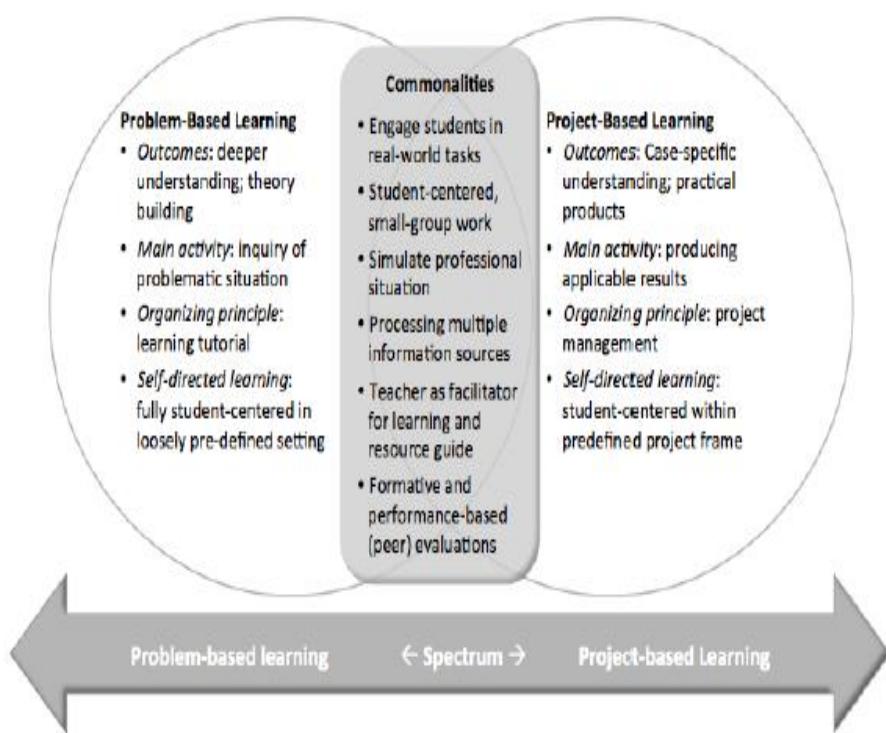


Figure 2.1: Spectrum of project based learning and problem based learning

Source: (Brundiers & Wiek, 2013)

Project based learning can provide students with the opportunity to obtain several benefits. The project enables students to enjoy their learning experience. In a study by Beres (2011), students reported that they enjoyed working together on a mathematics project, because they could learn a complicated mathematical concept in a fun learning environment. Similarly, in a study of mathematics using the project based method, Konrad (2014) reported a similar result. He discovered that the unique learning environment of a project based method could reduce students' anxiety in studying mathematical concepts (Konrad, 2014). Moreover, according to Savery (2015), students will remember their experiences in doing the project, and it is believed they will recall that memory when they have to face a complicated situation in the future.

Project based learning is also associated with improved student emotions. Helle et al. (2006) conducted a study on motivation in adopting project based learning in postsecondary education, and she found that project based learning has a positive impact on students' motivation. In addition, project based learning seems to ensure a more positive student attitude (Frank & Barzilai, 2004; Haugen, 2013).

However, project based learning is challenging. This learning method needs a substantial financial commitment to be implemented, which influences the program objectives and study achievements (Hanney & Savin-Baden, 2013). Developing a good project, similar to developing a good problem, needs a lot of preparation and uses a lot of resources. Therefore, students' achievements are hard to predict as the results are dependent on the budget provided (Hanney & Savin-Baden, 2013).

In addition, working on a project does not guarantee that students will enjoy the learning activity. Sometimes students feel uncomfortable learning in a new classroom environment (Beres, 2011). Beres' study shows that some found it difficult to adapt to project based learning. Students complained about the duration of the project because they were unable to finish the project on time, and some found that the lack of instruction was frustrating (Beres, 2011). Moreover, similar to problem based learning, group work can induce friction between students in a group, usually triggered by perceived unequal task distribution.

## **2.1.5 Scaffolding**

Researchers have shown that the teacher's role is still significant in helping students to obtain the skills needed through either the problem or project based learning method (Hmelo-Silver, 2004). Even when the teachers are not knowledge providers anymore, the teacher's guidance and instructions are still essential. Teachers' instructions and guidance are understood differently since the constructivist pedagogy tends to emphasize student-centered activities (Hmelo-Silver, Duncan, & Chinn, 2006).

There are some scholars who assume that the constructivist pedagogy proposes a teaching method using less instruction. Kirschner, Sweller, and Clark (2006) argue that any teaching method which only provides minimal instruction and guidance will not be able to develop student skills properly. Hmelo-Silver et al. (2006) point out that a problem solving pedagogy does not provide less instruction and guidance for students. It presents an instruction scaffold to support students to learn (Hmelo-Silver et al., 2006). According to Hmelo-Silver et al. (2006), an instruction scaffold or scaffolding will provide guidance for the students to go through the learning process effectively until they can discover the solution or complete all the tasks given. Moreover, according to Hmelo-Silver et al. (2006), scaffolding can encourage students to participate in a learning activity to persuade them to work on their tasks. This capability is due to the mechanism of scaffolding in directing students gradually. The instructions can be adjusted with regard to the students' progression at every stage.

Hmelo-Silver et al. (2006) described in their article that there are three types of scaffolding that are usually used in constructivist pedagogy. The first one is a type of scaffolding that can shape the students' way of thinking to become more strategic. By asking questions, a teacher can help the students structure all the ideas that they have obtained. The second type of scaffolding is working with an expert. At the time when students have a discussion or conversation with an expert to learn about a topic, it will help students to gain a better understanding about the topic. The third kind of scaffolding is an activity that organizes the students to do a task. This is a class activity which can monitor the progress of the task for each group. This activity is also dependent on teacher creativity.

### **2.1.6 Conclusion**

Several positive aspects stand out in each method. Studies on problem based learning indicate that students can achieve a higher degree of understanding and analytical

thinking about a particular issue (Brundiers & Wiek, 2013; Hanney & Savin-Baden, 2013; Hmelo-Silver, 2004; Savin-Baden, 2000). This is in line with the objective of problem based learning, which is to develop students' critical thinking (Hanney & Savin-Baden, 2013). Studies on project based methods found that students have better attitudes and motivation toward the learning activity. Most studies reported that students feel happy working collaboratively on a project (Baker, Pesut, McDaniel, & Fisher, 2007; Baş, 2011; Beres, 2011; Chiang & Lee, 2016; Frank & Barzilai, 2004; Haugen, 2013; Helle et al., 2006; Konrad, 2014), although only a few studies reported that students obtained better academic achievements (Baker et al., 2007; Konrad, 2014; Mioduser & Betzer, 2008).

Sustainability issues are complicated and interrelated with many different aspects such as political, cultural, environmental, and social ones. Therefore, students need to demonstrate excellent analytical skills to understand and deal with sustainability issues. In addition, to be successful in this field, students need to have high motivation and a good attitude toward learning. Combining the key characteristics from problem based learning and project based learning will satisfy the sustainability education requirements (Brundiers & Wiek, 2013). But little research has substantiated this. Furthermore, according to Demetriadis, Papadopoulos, Stamelos, & Fischer (2008), scaffolding plays a significant contribution in helping students learn in a student center learning environment. However, again there is a lack of studies that show how scaffolding works in practice with regard to sustainability teaching and learning.

## **2.2 Cognitive and Affective Domain**

### **2.2.1 Cognitive Domain**

The cognitive concept in the education field is related to the way humans process information in order to develop knowledge and skills (Ashman & Conway, 1997). All activities such as memorizing, recalling, thinking, and reconstructing information is considered part of the cognitive domain (Ashman & Conway, 1997). Understanding the cognitive domain is not limited to remembering or recalling the information. Bloom, Engelhart, Furst, Hill, and Krathwohl (1956) pointed out that how humans expand their intelligence, competencies, and expertise, as well as increase their consciousness, intuition, and understanding are also associated with the cognitive area.

The theory of cognition in education was introduced by Bloom et al. (1956). They created a classification of learning objectives or what is known as Bloom's taxonomy of the cognitive domain. Bloom's cognitive domain consists of six products or dimensions of learning outcomes which are correlated in a hierarchical structure. Starting from the lowest to the highest hierarchical category, they are listed as: knowledge, comprehension, application, analysis, synthesis, and evaluation (Bloom et al., 1956).

The knowledge and skills development process in problem and project based learning takes place through learning together (Bédard, Lison, Dalle, Côté, & Boutin, 2012). It can be said that the knowledge construction procedure is stimulated when students work to solve the problem collaboratively. The interactions among students when they have to solve the problem involve several activities such as thinking, remembering, and interpreting, and as has already been indicated above, those activities are considered part of the student competency building process. Related to this issue, Hmelo-Silver (2004) claims that when students are involved in a discussion, they try to recall their earlier knowledge. This mechanism makes significant contributions to the promotion of learning (Schmidt et al., as cited in Hmelo-Silver, 2004).

However, as Jaimini (2010) argues, group discussion does not always occur smoothly. Most of the time students argue during these sessions. However, this circumstance also has a positive contribution to learning (Jaimini, 2010). A deeper understanding of the particular problem or issue can be achieved unconsciously while students are building their arguments to defend their ideas in a group discussion (Hmelo-Silver, 2004). The same idea has also been explained by Mandeville and Stoner (2015). They point out that a debate which usually arises during interactions urges the student to respond. Students try to explain their ideas using the information that they have; accordingly, the knowledge construction process might be strengthened.

Most problem and project based learning employs real world problems as learning components. The real world problems are known to have a positive impact in boosting student knowledge construction (Greeno, as cited in Hmelo-Silver, 2004). It is also possible for students to increase their analytical thinking or their problem solving skills (Mandeville & Stoner, 2015). The characteristics of the real world problems presented become the key factors in determining the achievements of learning objectives. Consequently, developing real world problems which are going to be used in a course

should be done by an expert. Problem designers should have an excellent understanding of the course content (Mandeville & Stoner, 2015).

Besides real world problems, another feature in problem and project based learning is student reflection. According to Hmelo-Silver, student reflection increases student awareness, because by reflecting students are able to associate their experiences and what they have just learned (Hmelo-Silver, 2004).

### **2.2.2 Affective Domain**

In general, affective learning can be articulated as the emotional dimension of learning. This definition can be expanded into several other behaviour dimensions such as feeling and satisfaction (Savic & Kashef, 2013). Shephard (2008) defines the affective domain as value and attitude (Shephard, 2008). This idea is supported by Hansmann (2010), who stated that personal values and attitudes can be considered as the affective domain (Hansmann, 2010). Another definition of the affective domain is presented by Picard et al. (2004). He points out that the affective domain might be associated with the learner's personal behaviour, including motivations and interests (Picard et al., 2004). Beard, Clegg, and Smith (2007) agree by arguing that motivation is conceivably an emotional dimension.

A comprehensive definition about affective learning was given by Bloom and his colleagues. They points out that feeling, value, motivation, attitude and disposition are considered as making up the affective dimension in learning (Krathwohl, Bloom, & Masia, 1964). According to Krathwohl et al. (1964), the affective learning domain is the student's feeling which might arise through the teaching and learning activity. The affective dimension also can be understood as how the student's participation, actions, and understanding during the learning process can affect the student's behaviour, attitudes, or motivation. In this study, Bloom and his colleagues stated that the affective learning skill is associated with five products of learning: receiving, responding, valuing, organizing, and internalizing (Krathwohl et al., 1964). These five affective products are interconnected to each other in a hierarchical relationship, starting from receiving, which is the lowest position in the hierarchical connection, to internalization in the highest position (Krathwohl et al., 1964).

From this point of view, it is obvious that the role of the affective domain in a teaching and learning situation is crucial. It can help students obtain the learning objectives (Evans, Ziaian, Sawyer, & Gillham, 2013). According to Picard et al. (2004), there is a linkage between students' affective skills and learning performance. The motivated student tends to study more intensively than the unmotivated student. Furthermore, Picard et al. (2004) also found that if the students have positive emotions or feelings while learning, this situation strengthens their ability to make a judgment and improves their creativity. Similarly, creating a particular learning environment which supports students' desires to learn has the potential to improve student performance. An activity such as group discussion, role playing, problem-based learning, games, or expert engagement are considered as learning activities that have the capability to develop student affective skills (Shephard, 2008).

According to Hansmann (2010), the role of the affective skill in sustainability learning is very crucial. Besides the cognitive skill that can provide students with the ability to understand the complicated issues in sustainability, affective skills will develop human behaviour to support students in working in this complex environment (Hansmann, 2010). Moreover, Hansmann points out that the decision making process in the sustainability field will involve emotions, since the sustainability problem usually consists of social, natural, and economical dimensions (Hansmann, 2010). The sustainability issue is not only about the economic or natural environment, but it is associated with human behaviour as well.

Affective skills, after all, are part of the important components in the learning process that help students to understand sustainability literacy. As Hansmann points out, without motivation and a positive attitude toward the learning process, students will never obtain excellent learning objectives (Hansmann, 2010). Moreover, according to Sheppard, affective skills contribute in promoting students' perceptions toward sustainability (Shephard, 2008). Without involving emotions in the learning process such as motivation and attitude, it is impossible to create students who can appreciate their social and natural environments. However, affective skills are still considered as part of a new learning domain and not easy to be measured (Buissink-Smith, Mann, & Shephard, 2011).

### **2.2.2.1 Attitude**

In general, an attitude can be defined as a behavioural dimension which consists of several aspects such as cognitive, affective, and behavioural information (Ajzen, 2005; Pratkanis, Breckler, & Greenwald, 2014). In more specific descriptions, as several scholars argue, an attitude is about personal evaluative appreciation or a negative response toward an object (Ajzen, 2005; Haddock & Maio, 2004; Schwarz & Bohner, 2001). The concept of an attitude can be understood as a positive or negative state of mind, and an attitude is also described as an expression regarding an object.

Gal and Ginsburg observed that during the learning process, students' attitudes can be constructed from the total emotions that emerge while students do the learning activities (Gal & Ginsburg, 1994). If students have a pleasant feeling from their learning experience, this condition will bring a positive attitude to them. On the other hand, if they feel unhappy, this condition might create negative attitudes toward learning. According to Haddock and Maio, the role of feeling is acknowledged as being able to predict attitude (Haddock & Maio, 2004). For example, if somebody has empathy, he/she might have a positive attitude toward donating, and if someone is concerned about one's health, he/she might have a negative attitude toward smoking.

In a complicated learning environment such as in PPBL, students' attitudes toward the learning process can be considered as the sum of all the feelings that students have regarding all the learning components, including the role of the teacher or the teaching method used (Gal & Ginsburg, 1994). In PPBL, the learning environment is largely self-directed, which means the students have to find the information that they need. According to Carlisle and Ibbotson (2005), the self-direction learning method has the capability to develop a positive attitude in students. Baş (2011) points out that during a group discussion, students can freely express their feelings and opinions. This activity can generate a positive attitude for students (Baş, 2011). Moreover, Baş describes that when students gain self-confidence by showing their ideas or working on a project, this condition indicates that the students have acquired a positive attitude (Baş, 2011).

Another characteristic of PPBL that is understood to have the capability to improve students' attitudes toward learning is the project itself (Baş, 2011). Project-based learning mostly has an objective to require students to produce a final product. According to Baş (2011), this activity can improve students' attitudes. The most interesting finding about students having a positive attitude in a PPBL learning

environment was found by Mandeville and Stoner (2015). Their study was about assessing problem-based learning in a Biomechanics course for undergraduate students. They found that after students had graduated for several years, students still showed a strong excitement toward the course (Mandeville & Stoner, 2015).

#### **2.2.2.2 Motivation**

In general, motivation can be seen as an internal process which controls human orientation and behaviour (Hansmann, 2010). Meanwhile, according to Ryan and Deci (2000), motivation is an essential foundation that can generate mental support for someone to do an activity. They also pointed out that the degree of motivation toward a particular object is different from person to person (Ryan & Deci, 2000).

Motivation from the perspective of the learning theory is defined as the willingness of the student to attain a study objective (Mullins, Deiglmayr, & Spada, 2013). From the point of view of Mullins et al. (2013), the construction of student motivation is associated with students' perspectives about their grades and skills. It means the student's motivation to engage in a learning activity could be generated by grade achievement or it could be caused by skill achievement. Students motivated by grades alone like to be looked at as outstanding students, and when they cannot fulfill their ambitions, they will show a negative attitude toward a learning activity or task. On the other hand, if the engagement motivator is a skill or personal competence, then when students have to face a difficult situation, it will push them to work harder.

A problem and project based learning (PPBL) environment which encourages students to work in a group is recognized as being able to develop students' motivation (Hmelo-Silver, 2004). Not only a group work situation has a strong contribution to the development of students' motivation, but also other characteristics of PPBL, such as the style of instructions, teachers, and student interactions are believed to have a positive impact on increasing student motivation (Beres, 2011). According to Hmelo-Silver (2004), in a PPBL learning condition, students have the opportunity to study based on their own interests. Their freedom to determine what they want to learn at the end generates student intrinsic motivation (Hmelo-Silver, 2004).

During group activities students will share ideas. It might get a positive response from their friends. According to Mullins, student motivation might increase when they

receive positive feedback from their peers (Mullins et al., 2013). In contrast, negative feedback might discourage or demotivate students. Another way to increase student motivation can be done by presenting them with the benefits of learning a particular topic. Whenever students become familiar with the advantages that they might get by accomplishing their study tasks, then their motivation will increase (Bandura, as cited in Hmelo-Silver, 2004). According to Mullin et al. (2013), a student's personal motivation can be influenced by other students' motivation. If students have different types of motivation, their motivation might conflict with each other when they have to construct their knowledge through working together (Mullins et al., 2013). If a high motivated student has to work in a group with a low motivated student, it is possible that the high motivated student will be influenced and become reluctant to engage in a learning activity. Likewise, the circumstances might occur the other way around as well.

Lam, Cheng, and Ma (2009) point out that involving students in a real-world project is a useful teaching strategy that can increase students' intrinsic motivation. Similar to this idea, Hansmann (2010) reveals that a real-world project gives students a sense of satisfaction, because they can obtain valuable experiences through it. Furthermore, Ryan and Decy (2000) argue that independent learning (less teacher involvement), peer collaboration, and interest can be considered as other determinant factors of student intrinsic motivation.

### **2.2.3 Conclusion**

After all, as Shephard (2008) points out, the common practice in a higher education institution related to sustainability learning is seeking the cognitive outcome as a study objective (Shephard, 2008). The affective domain is considered more complex than the cognitive one and difficult to assess. This factor is considered as an explanation why the affective domain does not get more attention from academicians.

According to Buissink-Smith et al. (2011), it is not easy to measure the affective dimension as a learning outcome (Buissink-Smith et al., 2011). Measuring the affective dimension in a learning process needs more time and effort. The affective domain assessment should be very specific because it consists of many emotional dimensions. Therefore, to assess this skill, educators should focus on a particular attribute (Buissink-Smith et al., 2011). Furthermore, the affective domain is a relatively new issue

compared to the cognitive domain. Thus, the affective domain currently is still under study (Buissink-Smith et al., 2011).

### **2.3 Research Gap**

This study intends to address the issue related to the effectiveness of the problem and project based method for sustainability education. Thomas (2000) suggested the need to investigate the effectiveness of this pedagogy. The results of Thomas' study in reviewing research about project based learning provide recommendations to conduct research related to the effectiveness of a project based method with regard to a particular learning domain such as social skills, group process, metacognitive skills, and attitude (Thomas, 2000). According to Thomas (2000), the need to study in a specific domain is because most research in this area investigates problem and project based learning for a particular program. Furthermore, this study also strives to address Sheppard's work about the affective domain in sustainability education (Shephard, 2008). Shephard argues that education for sustainability is "a quest for an affective learning outcome" (Shephard, 2008). Therefore, a detailed study of a sustainability pedagogy which promotes an affective learning outcome is considered as crucial to be done. Additionally, Buissink-Smith et al. (2011) point out that a limited number of scholars have covered the affective domain as a learning outcome. Savery (2015) also argues that the effectiveness of this pedagogy still needs to be studied further. As a result, it is important to investigate the effectiveness of the problem and project based method through an in-depth observation of PPBL in developing students' attitudes and motivations as a learning outcome in sustainability education.

Table 1: Sustainability competency

<b>Sustainability competencies</b>
Collaboration skills
Stakeholders negotiation skills
Decision making skills
Understanding sustainability issues
Problem solving skills
Understanding the interconnectedness of human, natural system and organizations
Critical thinking
Communication skills
Understanding sustainability as key driver of transformation
Implementation skills
Knowledge integration
Think for the future

## **CHAPTER 3**

### **RESEARCH METHODOLOGY**

This chapter presents the methodology used for data collection and analysis in investigating how group work, project work, tutor instruction, and the involvement of a project guide influence students' attitudes, motivations, and skills toward sustainability in a sustainability course at AUT Business School. Together with the process of the data collection and participant recruitment, a research analysis for this study will be described in this chapter.

#### **3.1 Qualitative Case Study**

A qualitative approach was chosen to explore whether the Problem and Project Based Learning (PPBL) method influenced the development of students' attitudes, motivations, and skills toward sustainability. In particular, it was chosen to explore how students, lecturers, and project guides experience the learning environment provided by the new method applied. A case study was chosen to allow for the topic to be explored in depth through a bounded group (Yin, 2009). In this study, lecturers, students, and project guides of SUSE34600 semester 2 2015 at AUT Business School were participants in the case study. In conducting this research, the main purpose was to look specifically into students' affective and cognitive traits and the value of the experience for the external stakeholders (in this case, the project guides).

A case study was used to gain an in-depth understanding of learning activities and project guide involvement toward learning outcomes. The research questions of this study gave central attention to respond to "how" questions which were relevant to be answered using a case study method, as Yin (2009) stated that a case study is suitable to answer "how" and "why" questions (Yin, 2009). Moreover, according to Gillham (2000), a case study is suitable to be applied in a study which wants to understand humans as they are in their natural setting (Gillham, 2000; Yin, 2009). This study had research questions that addressed the effectiveness of problems and project based learning in developing student skills. Therefore, the units of analysis in this study were the problem and project based learning method. Extracting information from students and project guides can give legitimate data for this, and it has been done by previous scholars (Alessio, 2012; Bas, 2011; Bédard, Lison, Dalle, Côté, & Boutin, 2012; Ciftci, 2015).

### **3.2 Context**

In semester two in 2015, the AUT Business School implemented a new teaching method, the Problem and Project Based Learning (PPBL) method for the first time. It was conducted in an undergraduate course: Sustainability Enterprise Management. Through this method, students got involved in solving sustainability problems in a real project. To assist the students' learning, three sustainability practitioners already employed by AUT were asked to be project guides, helping students to obtain experience from sustainability problems in a real world context.

In total, there were eight groups working in different projects. The projects were as follows: battery recycling, content plan for sustainability web pages, labelling environmental choice, labelling fair trade, banning plastic bags, creating a sustainability communication plan, a sustainable transport strategy, and a bird feeder. Each student was free to choose a project that he/she was interested in. Each project was undertaken by three or four students. This course was delivered in twelve weeks, two hours for each session.

### **3.3 Population and Sampling**

The class being investigated consisted of the lecturer and 26 undergraduate students. Seven students were male and 19 were female, coming from different programs such as Marketing, International Business, and Human Resources. Also, among the 26 students, there were four exchange students enrolled in this course. As this course emphasized a real-world project, the lecturer decided to recruit three sustainability experts to be involved. Those three experts were recruited from an AUT internal organization. One was a sustainability coordinator, one was a communications coordinator tasked with communicating organizational sustainability initiatives, and the third one was a sustainability coordinator from a student association. In order to get a holistic picture of the case being studied, this study engaged each stakeholder in the data collection process: the lecturer, the guides, and the students. Holistic understanding and triangulation is considered as the strength of a case study (Yin, 2009).

This study employed non-probability sampling, a combination of purposive and self-selection (Saunders, Lewis, & Thornhill, 2009). Student and project guide recruitment was based on voluntarily participation. All students and project guides were contacted

to participate in this study, and those interested to join were followed up. Invitations to be involved in this study were sent by email. From 26 students, four students volunteered to participate, and two project guides also submitted their names. In order to maintain good future relationships with the project guides and not to put pressure on the students, it was decided to go with those participants who quickly volunteered their names, and not do too many follow up requests. The participation of a tutor in this study was purposely chosen as her expertise was considered important to answer the research questions. The tutor was contacted at the beginning of the initial plan of this study to ask for permission and her willingness to contribute in this study.

### **3.4 Data Collection Methods**

The case study supported the use of various data sources, as it generated stronger validity of the study (Yin, 2009). In this study, the main data source was interviews with students, project guides, and a tutor. Student self-reflection documents were used as a secondary data source. It was part of the students' assignments, containing their thoughts, comments, feelings, judgments, and observations of their learning process throughout the project duration. The interviews took place after the project was completed. All the interviews were conducted after the course marks had been handed out in order to minimize risks and reduce conflict of interest between the researcher and participants, between participants, and between participants and the tutor / project guide. To respect the participants' privacy and confidentiality, the details of all the participants were kept confidential from others including the tutor. Participants' identities were removed or coded. The data and consent forms were stored separately. An ethics approval form was sought and granted by the AUT ethics committee (see Appendix A).

#### **3.4.1 Interviews**

Interviews are a method of choice in collecting data, as it only involves a small number of respondents. Interviews have the ability to capture more important data when it involves a small number of people (Gillham, 2000). Interviews are also considered the most suitable method in answering a "how" research question (Yin, 2009). Interviews are the fastest method to understand people's perceptions (Travers, 2001) and deliver a reciprocal understanding related to the issues (Tracy, 2013). Through direct communication with respondents, a researcher is able to clarify an ambiguous statement.

A semi-structured interview format was chosen as the data collection method. It is a type of qualitative interview which is based on a series of questions that should be answered by respondents (Bryman & Bell, 2011). Semi-structured interviews can develop a natural conversation between the researcher and respondent (Gillham, 2000), while at the same time acquire consistent data across participants. This situation is beneficial to persuade respondents to tell more in-depth information, so the interviewers are likely to obtain sincere information.

Participants were offered a range of alternatives for the interviews: face-to-face, by phone, or by Skype. Two phone calls, one Skype call, and one face-to-face interview were conducted with the students, while the project guides and tutor opted for face-to-face interviews. The interviews with project guides and the tutor were held in their individual offices, while the one with the student was conducted at the AUT business school meeting room. Each interview lasted 30–45 minutes.

Consent forms and information sheets were sent via email before the interviews if participants chose not to have face-to-face interviews (see Appendix B and Appendix C). Therefore, the participants could read and sign the consent forms and return them back to the researcher before the interviews were conducted. For the participants who preferred face-to-face interviews, information sheets and consent forms were sent by email prior to the interviews. Accordingly, respondents were able to sign and return the forms back to the researcher when they met for an interview. Interview schedules were arranged based on an agreement between the researcher and respondents.

### **3.4.2 Reflection of Document Data**

In the course investigated, students were required to write a self-reflection based on Gibb's reflective cycle in weeks 4, 6, 8, and 11. The content had to include a description of events and situations as well as students' feelings and judgments about the learning process and related factors. They were also asked to analyze the situation, write a conclusion, and summarize their action plans. These reflection documents were considered as good data resources to understand students' feelings throughout the project. These reflections also provided rich information regarding the course and the students' learning process. Therefore, this study also used student reflections as a data source. The reflection documents were obtained directly from the students rather than from the tutor because the participants' identities had to be kept confidential and

protected from others. A statement to request the reflection document was included in the participants' consent forms. Three of the four students sent their reflection documents to the researcher by e-mail.

### **3.5 Data Analysis**

The interview data was transcribed by a professional transcriber recommended by AUT. The transcripts were then analyzed using NVIVO 11 to find matching themes and identifying patterns for each research question (Saunders et al., 2009; Yin, 2009).

The data was analyzed in two steps guided by research questions (see Appendix D). The first step was grouping the statements into four different categories based on research questions and sub-research questions. This step was done because the research questions were aimed to understand the influence of different components of the course towards the following aspects: students' attitudes, motivations, and skills. Therefore, it was deemed necessary to group the statements accordingly in order to prevent them from being misinterpreted due to mixed data. The first group consisted of statements related to the question about group discussions and class feedback. The second group consisted of statements related to the question about external expertise and the project. The third group had statements related to the question about scaffolding, while the last one had comments related to the question about the project guide as an external stakeholder value. All the participant interview data and student reflection documents received the same treatment.

The second step was axial coding. Interview transcripts and student reflection documents were coded and guided by the research questions. Codes were developed based on phenomena considered important for the respondents or related to the literature review. Similar codes were then categorized. To organize the findings, all the data was transferred to a word processor to be placed in a matrix table (see Appendix E) for further interpretations.

### **3.6 Research on Rigour and Trustworthiness**

A study about rigour and trustworthiness refers to the accuracy of the findings in describing the phenomena being studied. In a qualitative study, the validity of a study can be recognized as the quality of the interpretation process, or the trustworthiness and authenticity of the findings (Bryman & Bell, 2011).

In order to be rigorous, this study used four categories of data to be triangulated: student interviews, student reflections, project guides, and a tutor interview. Triangulation is a process to recheck the findings from a particular type of data source to another type of data (Bryman & Bell, 2011). Triangulation procedures were started by analysing each type of data separately using the procedure that has been explained above. Emerging codes from each type of data were compared and validated with other data. The data comparison process was done by placing all the codes in the matrix. The matrix consisted of four columns which represented each type of data source. The codes from student interviews were written in the student interview column. Then all the codes which emerged from the reflection document data analysis process were written in the reflection document column. The same treatment was given to data from the project guides and tutor interview. Additional information that the researcher presented in the matrix was the number of statements which supported the established codes. All the codes were then compared and validated to generate common themes that represented the whole data set.

According to Yin (2009), describing the research process in detail increases the trustworthiness of the study (Yin, 2009). Consequently, in this study all the research processes and steps were explained in detail. It covered how the sampling decision was made, the data collection procedures, and the data analysing sequence were all illustrated where needed with additional information in the appendix.

## **CHAPTER 4**

### **RESEARCH FINDINGS**

Project and problem based learning is an active learning approach which has several benefits including improving students' attitudes and motivations. It was discussed in Chapter 2 that the affective dimension is about value, attitude, and behaviour, which are essential outcomes for sustainability learning. Also, education for sustainability should be able to encourage students to think and act to promote better environmental change (Chalkley, 2006).

Therefore, the focus of this study is an evaluation of the PPBL teaching method in order to find out its ability to improve students' attitudes, motivations, and sustainability skills. This study is guided by these specific research questions:

1. How effective is the PPBL method in developing students' attitudes, motivations, and skills toward sustainability?

- How do group discussions and class feedback on projects contribute to students' attitudes, motivations, and skills towards sustainability?
- How do external expertise and the project contribute to students' attitudes, motivations, and skills towards sustainability?
- How does the tutor scaffolding method affect students' attitudes, motivations, and skills towards sustainability?

2. How valuable is the experience of being involved in the sustainability course for the external stakeholders?

From the analysis, four domains emerged in the findings: the decision making process, knowledge application process, communicating conceptual knowledge process, and organization performance. These four domains originated from eight themes extracted from the data. The decision making process is a domain describing the aspect of skill difference, cultural difference, and group communication behaviour contributing to the development of students' attitudes, motivations, and sustainability related skills. The knowledge application domain describes the importance of project guides and real-world projects in promoting students' attitudes, motivations, and skills. The communicating conceptual knowledge domain describes the role of the tutor in the skill development process.

A detailed explanation related to these domains and emerging themes will be discussed in the next section. The discussion is structured to follow the research question order, and not based on the order of importance or significance.

Table 2: Finding Matrix

	Domain	Theme	Code	Ref	
RQ1	Decision making process	Group Diversity Information Exchange Social Interaction Active Learning Teaching Resources Tutor Attitude	Skill Difference	4s/2d/t	
How Effective is PPBL method In developing student' Attitude, motivation and skills Toward sustainability?	RQ1a. How does group discussion and class feedback on projects contribute to student's attitude, motivation and skills toward sustainability?		Personality/cultural differences	3s	
			Communication	2s/3d/1p	
			Concepts Consolidation	2s/2d/1p	
	Higher order thinking development process		Cooperation	4s/3d/2p/t	
			Collaboration	4s/3d/1p	
	RQ1b How do external expertise and the project contribute to student' attitude, motivation and skill toward sustainability?		Practical Experience	3s/3d/2p/t	
			Expressing Idea	3s/2d/1p/t	
			Information gathering	1s/3d/1p	
			Challenge	2s/3d/2p	
	Communicating Conceptual Knowledge	Teaching Resources	Teaching Material	4s/2d	
	RQ1c How does tutor scaffolding method affect student' attitude, motivation and skills toward sustainability?		Instructional Activities	3s/3d	
	Tutor Attitude	Assistance	3s		
		Knowledgeable	2s		
RQ2.	Stakeholders Benefit	Organization Development Personal Development	Execute Organization Plan	1s/1p	
How valuable is the experience of being Involved In the sustainability course for external stakeholders?			Network	1p/t	
			Leadership	2p/t	
			Learning other perspective	2p/t	

(s=student; d=document; p=project guide; t=tutor)

#### 4.1 Domain 1: Decision Making

The domain of the decision making process was constructed from two themes: group diversity and information exchange. In general, this domain portrayed the extent to which students were equipped with the necessary skills for group work in response to the cultural variety in the group during the learning process and the information that was required to be processed.

#### **4.1.1 Theme 1: Group Diversity**

Participants expressed different opinions about the role of group diversity in the learning process: whether diversity had a positive contribution to skill development or it ruined the group dynamics. Two codes constructed this theme: skill differences and personality/cultural differences.

Skill differences: All students perceived that skill differences in their groups contributed to their attitudes, motivations, and skill development. This is supported by two out of three reflection documents analyzed. The contributions can be positive or negative towards their learning. Two students (RSP03 and RSP04) expressed that the existence of skill diversity in the group gave students the opportunity to distribute the tasks according to each individual skill which led to the successful completion of tasks.

*I found it interesting working with team members who all had their unique strengths and opinions. Learning how to use each other's skills and personal creativity to our advantage proved hard sometimes with conflicting views, but we all managed to compromise and bounce off each-other to create a better end result. This was an extremely rewarding feeling and made the teamwork experience very positive." (DocRSP04).*

Thus, based on both data sources (interviews and documents), skill differences contributed to the development of a positive attitude toward the learning process.

However, RSP01, RSP02, and RSP04 also reported that knowledge and skill diversity became a source of conflict in their group, especially when the difference was significant. Students who did not have adequate knowledge or skills did not understand how to work on the project. Thus, they did not contribute ideas for the group. Mature students who had skills developed from their previous working experiences reported that they were unhappy with this condition. One of them expressed that younger students might need more experience in order to be able to provide contributions to the group. Eventually some of them successfully learned how to manage the differences. A similar remark was made by the course tutor. According to her observation, second year students seemed to be a bit inexperienced to conduct a real project.

Personality and cultural differences: Another situation that students had to confront during the learning process was personality and cultural differences, as group members came from different backgrounds. These differences seemed to be beneficial in generating sustainability skills. Three out of four students expressed that they

successfully managed to work with different personalities. During the interview, RSP03 told the researcher that she learned how to manage personality differences and benefit from them, “*And we also started to learn a lot about each other’s personalities. Some were more comfortable being in front of the class and doing public speaking. Others weren’t so comfortable*” (RSP03). According to RSP01, working with people who have different personalities and cultural backgrounds gave her the opportunity to acquire cultural skills. In addition, she suggested that having a cross cultural skill workshop prior to the course might be very useful to help students in working on a project. However, no information on this theme was found in the reflection documents, neither from the project guides nor tutor.

#### **4.1.2 Theme 2: Information Exchange**

The second theme in the decision making process domain was information exchange. This theme covered students’ information processing activities during the learning process. This theme was developed from two codes: communication and concept consolidation.

Communication: Two out of four students and three out of three reflection documents mentioned that group communication processes contributed to develop their communication skills and creativity, as well as to improve their attitudes and motivations.

Two students stated that communicating with other people was exciting. Both RSP03 and RSP04 enjoyed communicating with their peers, either face-to-face or online. Moreover, RSP03 and RSP04 also said that their group communicated intensely in the project preparation, which was very helpful in the project completion. Furthermore, RSP03 said that based on the communication process, her group decided to develop an online communication channel through Facebook to help them work together.

In order to communicate effectively with her group, RSP03 learned how to develop clear communication skills. “*I acknowledge how imperative it is to communicate effectively with members of the group to ensure that tasks are understood and followed through as well as deadlines and project expectations are met*” (DocRSP03). Similarly, in her reflection document, RSP01 wrote that effective and intensive communication had a significant contribution in project report completion. She also wrote that she was

able to develop skills to communicate clearly and implemented those skills in her group presentation.

In contrast, a project guide noted that her student did not communicate efficiently among themselves. For example, when she gave information to one group member, it was not disseminated to other group members. “*I don’t think they communicated with each other very well either, because I would have one person email me for something that I supplied to another group member*” (PG2).

Concept consolidation: Two out of four students reported that they learned to collaborate with different ideas. RSP02 and RSP03 said that students learned to respect other opinions in the group interactions. Planning and decision making were based on discussions with all the group members. This is consistent with RSP01’s reflection document stating that, “*The group dynamic is evolving further. I think I managed to respect others’ opinions and could view them from a different perspective. I am finding this group work challenging, but I have developed learning beyond what I would have thought*” (DocRSP01).

Through communication in the group, students were able to consolidate different ideas. According to a project guide, some groups were capable of developing one final group outcome constructed from several different ideas that came up within the group. This was emphasized by RSP01 and RSP04’s reflection documents. According to the documents, during discussions to develop a solution for their project, all members came up with different ideas which were then consolidated into one final outcome. Therefore, this process of consolidating different ideas was able to alter their knowledge and increase their motivation (RSP01).

## **4.2 Domain 2: Higher Order Thinking Development**

Learning activities related to real-world projects of sustainability are done to promote students’ deep understanding of the fundamental concept of sustainability issues. As a result, the higher order thinking development domain describes the effect of student activities in completing real-world projects for attitudes, motivations, and skills. There are two themes in this domain: social interactions and active learning.

### **4.2.1 Theme 1: Social Interactions**

Social interactions represent the contributions of students' social interactions in the affective and cognitive development process. There are two codes in this theme: cooperation and collaboration. Cooperation describes students' social interactions with project guides and with other stakeholders. Meanwhile, collaboration is students' interactions with their peers. In general, this theme contains students' social interactions during the learning process and its contributions to attitudes, motivations, and skill developments. All students participating in this study reported that social interactions had a significant contribution to students' attitudes and motivations and also contributed in developing their sustainability competency.

Cooperation: All students said that the guidance and assistance given by the project guides in the learning process assisted in fostering students' positive attitudes and developing students' sustainability skills. All reflection documents also implied the same point. Furthermore, two out of four students claimed that working with external stakeholders enhanced their understanding of sustainability issues.

There is much evidence showing that project guides' involvement contributed to students' positive attitudes during the learning period. Project guides were portrayed as being helpful in the drafting stage (RSP03), for answering questions (RSP02), and for being enthusiastic (RSP 04). As RSP04 said about her project guide, "*She had a lot of enthusiasm as well, and she was very grateful for what we were doing which was also good*" (RSP 04). Additionally, RSP01 stated that her perspective toward group assignments to produce a project final report was also positive because of the feedback from her project guide.

Students' reflection documents bore evidence of the contributions of project guides towards students' positive attitudes regarding the learning process. For example, as a result of a meeting with her project guide, RSP04 wrote that the task ahead seemed to be easier. "*After our meeting with our project guide to define a timeline, I felt at peace of mind again. The task seemed less daunting with set time periods for achievable goals*" (DocRSP04).

Besides promoting students' positive attitudes, the project guide contributed in the learning process by developing student intrinsic and extrinsic motivation. As RSP03 said, she was always looking forward to meeting with her project guide to discuss the

group project. This was confirmed by a project guide, who said that several students regularly contacted her for a meeting. “*Some of the students were really motivated and keen, and they kept in good contact with me and wanted to meet*” (PG01). This was further confirmed in the reflection document that despite the tight schedules the members had, the group still made a great effort to meet with the project guide in order to receive feedback. “*I also felt that each member, despite being very busy, each made an effort to meet whenever we had to meet with the project guide which was an empowering effort as we were all present to receive valuable updates and feedback from our project guide, thus, meeting our deliverables with a better understanding, clarity, and focus*” (DocRSP03).

Working with project guides improved students’ motivation to achieve better results. As expressed by RSP03, “*So we knew where we were going and how we were going to get a good outcome through her guidance and her feedback on our drafts and our briefings*” (RSP03). This was supported by RSP01, who said that she could produce a good quality report through the project guide’s guidance. In addition, in her reflection document, RSP04 wrote that the project guide’s attention toward the progression of the project developed her motivation to work on the next task. She also made sure that other team members did their research before meeting with the project guide.

Project guides’ involvement also contributed to develop students’ capability in planning a project. According to RSP01’s reflection documents, her project guide showed her how to develop a work plan. Her project guide also helped her to choose an essential strategy to complete the project. “*We contacted our project guide for a meeting and planned a group discussion beforehand to discuss how to implement the critique for her further feedback. During our meeting, we defined our target markets for each page, possible features of our design to make it more focal, and a general outline of a timeline to work off*” (DocRSP04). This was also confirmed by the course tutor. According to her, one of the reasons to ask project guides to be involved in sustainability learning is because students need to acquire practical skills from them. She was able to see that some students had successfully acquired those skills, “*I think they understood that mostly you need to plan for sustainability, you need to work together for sustainability, you know, some of those things*” (TR01).

Another skill that students acquired during working and learning together with project guides was about organizing tasks. Students learned how to structure a task and divide it into several subtasks. As written by RSP01 in the reflection, “*Project guide (\*name edited) recommended, engaged us, and showed us examples to research structure and how to divide it into subtasks*” (*DosRSP01*).

According to students’ perceptions, they also learned to be professional from project guides. RSP04 stated that her project guide showed her how to work under the organization’s guidelines. The project guide introduced her to a real working situation and showed her how to be professional at work, although it could be difficult to adapt to such a requirement. “*I felt disappointed that we couldn’t go more in-depth. However, I came to realize that when working with a corporate organization the client has final say, meaning we have to work according to their guidelines regardless of personal preference*” (*DocRSP04*).

Project guides also showed students how to develop their networking and negotiation skills during the learning process. A project guide (PG01) explained that most students in her groups learned how to find a subcontractor and negotiate with them. Students also actively contacted other organizations that could be useful for their project, such as a group contacted an environmental organization and conducted an interview with them. All those initiatives were planned and done by students. This was further confirmed in a reflection document, “*because it teaches you to be more careful when you do your negotiation, yeah, it teaches you a whole bunch of skills I think, yeah*” (*RSP01*).

Regarding the role of the project guide as an information provider, RSP03 stated that information from the project guide helped her to think beyond her preconceptions related to a particular issue. The project guide’s information could open her mind and allow her to see sustainability issues differently from her initial perception. Meetings with the project guide fostered their positive attitude toward sustainability learning, especially through instilling curiosity on the topic. “*She was also very helpful in passing information that she knew would be helpful for us without so much like spoon-feeding us. She was just giving us helpful hints on places to research, and that was really good*” (*RSP 03*). In her reflection document, RSP02 expressed the same perception. She said that she enjoyed getting new information from the project guide, and also she was amazed about what she had learned. Finally, a project guide confirmed this point. “*I*

*think all of the groups that I worked with, they, at least one or two of the meetings I had with them, they highlighted the information that they'd been learning about particular issues" (PG01).*

Despite the positive contributions explained above, there were also negative notes on collaborative learning. A project guide commented that one group was not motivated; it was really difficult to encourage that group to meet with her. This particular group suffered a general lack of communication skills. "*I think the communication with external stakeholders and with each other was not the best*" (PG2).

Moreover, two students also felt that their project guides did not give sufficient guidance to help them stay on the right track with their project. They thought that the project guide was not always available to direct them when needed. This was actually confirmed by a project guide, since as it was the first time for her to be involved in this kind of a project, she was not sure about students' expectations, "*Because it was the first year that they had done the paper that year, and none of us were entirely sure what to expect from ourselves*" (PG2).

**Collaboration:** All students and all reflection documents showed evidence that group work had an important contribution toward students' attitudes and motivations, as well as contributing in sustainability skill development. This was also confirmed by both project guides.

It was found that learning in a group developed students' positive attitudes. For example, RSP02 said that she was happy to have the opportunity to work with people of all ages, while RSP04 said that she preferred learning in a group rather than individually. In her reflection, RSP01 expressed that she enjoyed successful group work. "*I am enjoying successful group work and moving towards a more cohesive group. Attitudes, collaboration, feedback, the speed of project movement, and respect for others are important*" (DocRSP01). Similarly, RSP04 wrote that group work learning was a good experience for her, because she was able to learn how to work as a team.

Learning in a group triggers motivation. A student told a story about renting an electric bike by her own initiative and showing it to her peers in the group in order to

understand a particular issue about sustainable transportation. “*I got one (e-bike) in Newmarket and what I did is I showed it to the students, so that was real learning by doing*” (*RSP01*). RSP03 said that others’ support in the group motivated her to do well in the course. This was confirmed by the reflection documents. RSP04 wrote that group learning motivated her to do her best in contributing for the group, while RSP01 wrote that she had planned to contribute more to the group since she had the capability to do that.

Working in a group also enhances engagement. RSP04 wrote in her reflection document that working with other students who had different strengths and perspectives was very engaging. Most students participating in this study stated that they were happy working in a group because they could see the benefits, such as, “*In terms of working in a group it was also a good experience, as it was a good way to ease into how we were going to function as a team*” (*DocRSP04*).

In group work, students practiced how to apply the task distribution knowledge they got from the project guide. RSP02 thought that her group successfully distributed the task based on members’ preferences. Similarly, RSP03 said that each team member decided to focus on a particular area. “*And so the three of us, we decided we’d each focus on an area, so we could get the most out of each area*” (*RSP 03*). In RSP01’s reflection document, it was written that her team leader delegated tasks for each member clearly. RSP04’s reflection also stated that her group had distributed the tasks to each member since the beginning when they set up the group timeline. “*Therefore, at the beginning of the timeframe, we were able to confidently set tasks for each person knowing that everyone was capable, reliable, and efficient in completing their tasks*” (*DocRSP04*). These statements were also confirmed by a project guide. Students had successfully delegated the tasks to each member and they did the job really well. “*And I think they just showed initiative and were really keen and engaged, and also I think tasks had been divided up amongst themselves and each of those group members had actually done a really good job or worked hard to do their best on that*” (*PG01*).

Collaborative sustainability learning has been identified as being able to develop students’ organization skills. A clear message about this issue was provided by RSP04. She said that she had learned how to manage people and how to determine group objectives. Meanwhile, other evidence was found from RSP01’s statement. She said in

order to organize her group, they made a group contract and they distributed the tasks based on a common consensus. Furthermore, there were many references in the student reflection document which showed that collaborative sustainability learning had developed students' organizational skills. One piece of evidence was from RSP01's reflection. She wrote that she had recognized the key leadership qualities that she believed would help her to complete the project. From RSP03's reflection document, the researcher found that she had learned how to lead and organize her group. "*I have found myself in some kinds of facilitative roles as I am usually making the first point of contact with the other group members to query and discuss plans regarding our project*" (*DocRSP03*). RSP04 also wrote in her reflection document that her group had successfully organized the project work efficiently. Besides dividing the tasks into several small sections, her group also had set up a regular meeting time and decided to commit to that.

Another skill that can be identified during group work is time management. As RSP03 described, her group had a lot of meetings in order to complete the project, although each member had a tight schedule, including herself. Therefore, she needed to organize her own time and also the group's time effectively. In addition, RSP04 wrote that her group functioned very well because they had good time management. "*This led to a well-functioning team and we weren't stressed out or didn't put off our tasks since we delegated our time and input wisely*" (*DocRSP04*). However, not all group members had the ability to show this skill, as PG02 reflected about her group. She said that her group had very poor time management.

Students as individuals are also identified as being able to learn and work autonomously, as in this learning environment students are encouraged not to rely on lecturers' guidance. Students need to be able to organize everything themselves, and learning is dependent on their own will. RSP03 said that she had to be able to organize her own work during the learning period. "*In a similar way you have to really manage your own independent workload, work with a team, and manage your time. All those kinds of skills are very valuable*" (*RSP 03*). This was confirmed by RSP01's document that she was able to produce a good quality outcome because she could manage her time effectively.

Those findings show a significant contribution of social interactions for students' attitudes, motivations, and sustainability skills development. Whether the interactions occurred among students or project guides/stakeholders, both of them had a significant impact on the affective and cognitive development.

#### **4.2.2 Theme 2: Active Learning**

Active learning describes the benefits of problem solving activities for attitudes, motivations, and sustainability related skills. This theme consists of four codes: practical experience, expressing ideas, information gathering, and challenges. Each of them will be described in detail in the next section.

Practical experience: Four students, two project guides, and the tutor believe that the practical experience which the students got from working on a real-world project provided significant contributions in developing students' attitudes, motivations, and skills. Evidence of this claim can also be found in students' reflection documents.

The practical experience students got from working on a real-world project allowed them to develop positive attitudes. RSP04 said that working on a real-world project was a good experience for her, while RSP02 said that she was really interested to know more about the issues from the project her group did. In addition, RSP03 stated that working on a real project was a valuable experience, "*I think that is very valuable. It was very realistic learning*" (RSP03). The reflection document also confirmed this. For example, RSP01 wrote that she was very glad that she could learn several different projects in the sustainability field, although she was disappointed because she could not get her first choice. RSP04 wrote that she would apply the knowledge she got from real project learning in the future. Further confirmation by the project guide found that it was clear that students were interested to learn more. "*They were interested to learn about why I was concerned about biodiversity. They learned things that they didn't know about the country that they lived in their whole lives, so they did learn things*" (PG2).

RSP03 further said that working on a real project motivated her to learn more. As she said, "*We had to go out and really take all of what she'd said and bring the communication plan to meet what was asked of us, to meet the expectations of the group*" (RSP03). RSP02 wrote that she was very enthusiastic with the project tasks. From the project guide side, a project guide said that some groups showed great

initiative when working for the project. The tutor noticed that her students showed a great amount of motivation. “*Some students were a bit too organic, like they sort of glanced at the project briefly and then they just charged off and decided to do their own thing*” (TR).

Real world activities also develop students’ emotional intelligence. While working on a project, some students learned to maintain group emotions. As written by RSP03, she was starting to understand the importance of empathy, respect, and mindfulness in order to get a better outcome for the group. “*I am mindful that my team members are studying different majors and are both half way into a conjoint and a double major respectively. At this stage, I plan to encourage a reminder of our code of conduct that was outlined in our team contract and initiate a brief discussion about how we are feeling towards the project so far*” (DocRSP03).

Practical experience also contributed in improving students’ awareness and understanding towards sustainability issues. According to PG01’s information, practical experience could expand students’ perceptions, and her group gained a deep understating toward the sustainability issue. “*It was likewise with battery recycling, because it was something so practical. There were theoretical links there for the projects as well, but because it was so practical and grounded in the real world I think it really helped them in their understanding*” (PG01). Moreover, RSP04 said that her experience made her understand the response of a corporation toward sustainability. Through her involvement in a sustainable transport project, RSP01 said that she became aware of the sustainability problem that Auckland faced. “*Just awareness, awareness of the thick pollution in Auckland, quite bad, yeah. I think it's just in general that awareness and the interest as well,*” (RSP01).

Their involvement in a real-world project also triggered the development of analytical skills. As described by one of the project guides, she could see that some students developed a logical association between the issue that they got from the project and the particular sustainability problem (i.e. loss of biodiversity) in general. Students also learned basic research skills, particularly by learning that they did not have to reinvent the wheel. “*We basically had research to see how other universities display this kind of information*” (RSP 04).

However, a negative feeling towards practical experience was also found. A project guide said that not all students were motivated. She said that some groups under her supervision showed high motivation to work on their project, while other groups seemed reluctant to complete their project. Another project guide also said that her group lacked motivation and was not engaged with the process to accomplish their task for the project. “*I felt that my group lacked motivation a lot. They weren’t very engaged with the project which was quite disappointing*” (PG2). RSP03 also told the researcher that one of the students in the class told her that he was not happy because he did not know what he had to do.

Expressing ideas: Three out of four students claimed that the opportunity to share ideas with other people had contributed to positive attitude and motivation development. The ability to communicate ideas also contributed to skill development. Some evidence can be found from student reflection documents and project guide/tutor statements.

RSP03 said that the opportunity to convey a particular idea to other people made her feel great, while RSP04 said that she was very satisfied that she had the opportunity to influence others through her project outcome. Moreover, in her reflection documents RSP03 wrote that she was happy to be able to present her group’s work for other students in the class and have the opportunity to build her presentation skills. “*Having said that, I am pleased that there is an oral presentation component to this paper which allows people whose writing skills aren’t as strong to further express their knowledge*” (DocRSP03). RSP04 wrote that she was energized when her presentation brief was ready.

The opportunity for students to express their ideas also developed students’ self-confidence. RSP02 said that she learned to speak up. “*I had to speak up more. I spoke up but I spoke up too late. So if I, if there was a question or issue, I learned to speak up right from the beginning rather than leave it till the end*” (RSP02). Similarly, RSP04 said that she became more comfortable and confident in expressing her ideas to others.

Information gathering: One out of four students and three out of three documents stated that students’ activities to collect information were able to help them develop positive attitudes and motivation, as well as to generate sustainability skills.

In her reflection document, RSP04 wrote she did research on Facebook as an early preparation for the project, and it was engaging and motivated her and other group members. RSP01 wrote that she was enthusiastic to learn how to ask further questions in order to get more information.

**Challenge:** Two out of four students and three out of three reflection documents stated that the challenges that students received during the learning process contributed to their attitudes and motivation. Some evidence showed that challenges could either improve students' attitudes and motivation or demotivate them.

RSP03 said that she saw the challenges as building blocks that could improve her skills. Furthermore, RSP01 wrote in her reflection document that the challenges from her project excited her. These two statements showed that challenges could improve students' attitudes and motivation. These statements were also confirmed by the tutor. She said that although some students had difficult projects, they managed to complete them with excellent results. "*They received good marks actually, you know, because for everything they did we still thought, well, actually, they did a great job given that they had a difficult context*" (TR).

However, several statements expressed a different perspective towards a challenge. RSP02 said that she found some organizations did not want to give information to her group. This difficult situation decreased her motivation. RSP01 wrote in her reflection document that she was frustrated when she needed more information but no one seemed to be able to help her. Here, the actual real life reality that making a difference is not always easy hit the students.

These findings show that problem solving activities such as expressing ideas and collecting information positively contribute in developing students' attitudes, motivations, and sustainability skills development. Meanwhile, students' research experiences and the challenges that they have to face affected students' skills and emotional development.

#### **4.3 Domain 3: Communicating Conceptual Knowledge**

This domain describes how lecturers contribute in developing students' attitudes, motivations, and skills toward sustainability in a problem and project based learning environment.

#### **4.3.1 Theme 1: Teaching Resources**

Teaching resources consist of two codes: teaching materials and instructional activities. Each of these codes will be discussed in detail in the following section.

Teaching Materials: Four out of four students claimed that the teaching materials enabled them to have positive attitudes and motivation. The teaching materials also contributed in developing their sustainability skills.

The teaching materials provided a significant contribution in developing students' positive attitudes and motivation. RSP03 said that the materials that she received from lecturers were very helpful and motivated her to learn more. RSP01 also had a similar perspective about the teaching materials. She said that the topic was very interesting. RSP02's statement reveals that she was really excited to learn because there were a lot of topics which she had never learned before. "*I'm actually interested and there were things I'd never learned before, like, oh, industries I didn't know about and I benefitted finding out about the mad cow*" (RSP02).

The teaching material also improved students' understanding toward sustainability issues. RSP04 stated that at the beginning there seemed to be no connection between the teaching materials and the project that she was doing, but when she looked at the big picture she could understand the relations. Meanwhile, according to RSP03's reflection document, she revealed that the teaching materials from the lecturer contributed significantly to her exam and also helped her to understand the issue from the project. "*Having done the exam, I must say there is a great deal of knowledge to bear in mind and effectively use and apply to projects*" (DocRSP03).

Instructional activity: There were three instructional activities covered in this study: tutor's lecture, guest lecture, and writing reflection. Three out of four students had a perspective that the instructional activities could improve their attitudes and motivation. They also believed that the instructional activities contributed in developing

sustainability skills. Evidence was also found in three out of three student reflection documents.

Evidence showed that the tutor's lecture allowed students to develop positive attitudes toward learning. RSP03 said that she liked to hear the explanation from the tutor, as she thought that the tutor had a deep understanding towards the issues she explained. RSP01 wrote in her reflection document that she became aware of a particular sustainability issue after she had a conversation with the tutor in the class. RSP04 conveyed that the information from the tutor in the class made her rethink about her consumption pattern. *"It got me down thinking that nothing I could do would make any substantial difference. But I decided I could help in my own way by rethinking my consumption patterns in everyday life"* (DocRSP04).

There were also guest lecture sessions arranged in class. Students believed that expert guest lecturers could develop their positive attitudes toward learning and toward sustainability issues. Two students said that they were glad to have the opportunity to hear information from sustainability experts. RSP01 stated that she was really inspired by the topic of the guest lecturer presented in the class. She also added that the guest lecturer brought her out of her comfort zone by showing uncomfortable sustainability stories. *"Yeah, lots, especially that one from a guest lecturer (\*name edited). He got us to do all sorts of terrible things! He got us out doing, stepping out of our comfort zone, and because I've got children and my husband too, and I've been really challenging them"* (RSP01). RSP03 commented that she was happy to have a guest lecturer that presented a sustainability issue from his expert perspective.

Writing a learning reflection is another type of instructional activity. RSP01 said that writing reflection documents was very helpful and helped her to be honest. Moreover, according to RSP04, she was happy writing the reflection documents, because it could make her see that she was actually learning. *"I guess it was just a good opportunity to kind of find out what you've been doing right and what you've been doing wrong in your group and just correct it for the next time, so that was good"* (RSP04).

Students also said that writing reflection documents improved their motivation to get good grades, because writing a reflection was part of the marking components. RSP04 declared that writing reflection documents was not too difficult; therefore, she had a

chance to get a good mark. Similar with RSP04's response, RSP02 stated that writing a reflection document was part of her obligation as a student. "*To me, it was just something we had to do; it was part of the course outline; it was expected of us; it helped towards our mark*" (RSP02).

Writing a reflection document can also develop students' monitoring skill progress. RSP04 stated that writing a learning reflection was a good activity that could remind her about activities she did during a learning period. RSP02 had a similar perspective. According to her statement, writing a reflection document helped her to remember a particular learning activity. "*It probably made me keep track of how I'm improving personally. Yeah, I did notice that I was like, oh, I've improved from that, I'm learning, I didn't actually reflect and realize I was doing that*" (RSP02). Moreover, RSP01 commented that writing a reflection document gave her an opportunity to develop a better plan.

However, a negative perspective toward writing a reflection was also found. According to RSP02, writing a reflection did not help her work for the project. "*So it didn't contribute to the work I'm doing*" (RSP02). Similarly, RSP03 said that she could not see the correlation of writing reflection documents with the practical skills that students will need in the work place.

#### **4.3.2 Theme 2: Tutor's Attitude**

In problem and project based learning, students spend more time to learn outside the classroom. However, the tutor's position in this pedagogical approach is still important for students. The tutor's character develops positive attitudes and motivation. A tutor's character is constructed from two codes: assistance and knowledge.

Assistance: Three of four students mentioned that the tutor was very helpful. The tutor's willingness to provide support for them could develop positive attitudes toward the learning process. RSP01 described her opinion about the course tutor. "*I really enjoyed it; it was really helpful. I think the lecturer (\*name removed) was great*" (RSP01). RSP03 told the researcher it was really meaningful for her to have a tutor who was always available for the students.

Knowledgeable: A knowledgeable lecturer was found to develop students' positive attitude toward learning. Two out of four students mentioned that the tutor was very intelligent and well-informed. Both of them had the same opinion that having a knowledgeable lecturer improved their attitudes toward learning. RSP02 stated that she liked to hear the explanation from the tutor in the class. "*And she (\*name removed) was a good teacher. I liked listening to her. She knew what she was talking about, so I liked that. That increased my motivation and it confirmed I was in the right area of study*" (RSP02). RSP02 also expressed the same point of view. She said that her tutor knew a lot about the learning topics and that made her happy.

#### **4.4 Stakeholders' Benefits**

This part explains the answer to the second research question, addressing the benefits received by external stakeholders for their involvement in the learning process. The source to address this question was mainly from project guides with additional information from the tutor and students. This domain emerged from two themes: organization development and personal development. These two themes will be discussed in detail separately.

##### **4.4.1 Theme 1: Organizational Development**

This theme represents the benefits that an organization earned through their involvement in a sustainability problem and project based learning. According to PG01, several projects given to students were actually unexecuted projects in her organization. "*Some of the projects though, for example, the battery recycling project and the plastic bag ban, they were projects, initiatives that I wanted to do anyway and I had thought that that it was a potentially good way of making something happen through the student sustainable enterprise management paper and the students moving it forward*" (PG01). Therefore, project guides' involvement in the learning process helped their organization to carry out a project which could not be executed before. PG01 also stated that she was really happy because those projects could be covered in sustainability learning. She also added that this situation could become a good reason for her manager to decide a long term contribution in the sustainability learning process. This benefit was confirmed by a student's opinion. "*They're taking advantage of the students; it's great; they benefit by the students doing that*" (RSP02).

Network: Another benefit that an organization might get through their involvement in the learning process is by extending the organizational network. Based on PG01's explanation, by getting involved in a particular project with the students, she was able to develop better relationships with other organizations. PG01 explained, "*And for the Fair Trade environmental choice, they were useful pieces of information in terms of improving my information but also by being able to send it around to colleagues to improve their understanding of those two different labelling regimes*" (PG01). Furthermore, according to PG01's information, a particular project initiated a new relationship for her organization. She got a new important network from the project which had been done by the students. "*With the battery recycling, yes, that was really useful because the information the students gathered was useful for me to then go and push that forward because we've got a clear idea of supplies that could provide a better recycling service. Yeah, that's something that we're going to be moving forward*" (PG01). Moreover, PG01 stated that she would take further action based on the information that students collected during the battery recycling project. Therefore, her staff would not have to do the work anymore. She would also deliver other projects that she supervised to her relevant partners.

The course tutor also confirmed this view. She said that the benefits reaped by the external organization were mainly in creating a lot of connections. Furthermore, she said that an external organization's participation in the learning process introduced students to an expert, which would then benefit the organization. "*And the people who did the transport project they got the expertise of a sustainability officer, you know, and so we don't have expertise, we are academicians, right, and so I think it helps them to also get that practical expertise*" (TR01).

#### **4.4.2 Theme 2: Personal Development**

Not only did it benefit the organization, but being involved in this project brought individual benefits to the project guides. According to the project guides, there were two personal benefits that they got through their participation in the sustainability learning process: leadership skills and understanding other people's views.

Leadership skills: Both project guides revealed that their involvement in the sustainability enterprise management course improved their leadership skills, as PG02 said, "*It was very valuable I believe. I've learned a lot from it. I was never a supervisor*

*of a project before so it was an interesting experience for me” (PG2).* PG01 said that her involvement in sustainability learning gave her more understanding about what will be required if she has to develop people’s skills, which is very valuable in completing a sustainability project. In addition, PG01 commented that she gained experience to interact with students during the learning process and she learned how to understand their expectations. The course tutor confirmed this by saying that the experience of being involved in sustainability learning would give project guides some insights into what academic aspects contributed to the sustainability area.

Learning about other people’s viewpoints: According to the tutor, a project guide could learn to understand about an education institution’s role in the sustainability field. “*They get a sense of what we are actually doing; we’re often too separate; there are the people who are teaching and then there are the people running AUT, but ideally you would know from each other what you were doing”* (TR01). Similarly, PG01 said that she was starting to understand what students were supposed to learn and how the students acquired negotiation skills or research skills. These experiences enhanced her skill to persuade someone to implement a particular sustainability project. PG02 stated that she got a valuable experience by knowing that sometimes it was very difficult to share her point of view to other people. According to PG02, people might think differently and she learned how to transfer a specific idea.

## **CHAPTER 5**

### **DISCUSSION AND CONCLUSION**

The purpose of this study was to conduct an evaluation of a learning outcome from a sustainability course implementing problem and project based method. In summary, the findings of this study support problem and project based learning (PPBL) as a good pedagogy to promote sustainability competency. PPBL helps students to develop desirable sustainability behaviour and skills through social interactions. Students' interactions with their peers in a group discussion are proven to be an effective method to develop the communication skills required for sustainability implementation. Group discussions are also proven as an effective way to improve students' attitudes and motivation toward sustainability learning. Thus, on the basis of this study, it can be said that engaging students with a real-world project/problem is an effective pedagogy to promote sustainability competency. Besides having an affective outcome, other skills are also obtained such as organization skills, time management skills, and presentation skills. The study also found that while the problem and project based method stimulates students to study independently, the role of the tutor and project guides is still significant in developing students' motivation and sustainability skills.

#### **5.1 The Role of Group Discussion in PPBL for Sustainability**

In the sustainability course assessed, each group consisted of students from different study backgrounds. Some groups also consisted of mature students and exchange students from different countries. Therefore, the composition was diverse in several ways. The finding clearly stated that in general group diversity was beneficial for students. Group diversity was found to help students to improve their attitudes and motivation, as well as develop their sustainability skills.

Students perceived that having different personal skills positively contributed toward their attitude development, and it helped them to organize the project-related tasks. It seems the tasks were distributed based on students' personal preferences and strengths. Each group member chose to do the tasks related to their own prior skills or study backgrounds. This arrangement potentially reduced students' anxiety and uncomfortable feeling. It might also have enhanced students' ability to break down and distribute the tasks.

Differences in personality and cultural background contributed to students' ability to manage people with different characteristics. Students had the opportunity to learn to understand their peers who came from different cultures, had different personalities, and had various interests while they were involved in an intense group discussion.

These findings support Jaimini's (2010) study. Jaimini argues that diversity might contribute positively toward student knowledge development (Jaimini, 2010). According to Jaimin (2010), age, gender, or prior skills diversity in a group might affect group interactions and support knowledge development. However, Jaimini (2010) does not mention a particular type of diversity or the contributions to specific skills or knowledge development. He studied the contributions of group diversity in general. This present study provides more detailed information. This study shows that diversity in prior skills, culture, and personality contribute to the development of specific skills in the sustainability area.

Furthermore, the findings of this study convey that group interactions contribute in improving students' attitudes, motivations, and sustainability related skills. This finding confirms Savin-Baden (2000) and Shephard's (2008) argument that education methods which encourage students' interactions might not only develop students' attitudes and skills but also improve their knowledge. The process of information exchange during group discussions gives students the opportunity to explain and substantiate their ideas while respecting others' opinions. Through this process students can generate a deeper understanding about sustainability issues and improve their ability to express their opinions clearly. This is particularly important for sustainability, as it often involves having to convince others of the need for a sustainable practice. Savin-Baden (2000) explains that group discussions also improve students' problem solving skills in addition to improve students' motivation. Similar to Savin-Baden (2000), this study found that students were motivated to complete their sustainability projects.

Student interactions were found to be an interesting and exciting activity. Therefore, the opportunity to communicate and share information positively contributes toward students' attitudes. This finding confirms Soller (2001), Shephard (2008), and Baş's (2011) findings that in a group discussion, students not only learn to construct a logical argument, but they are also able to share their feelings, which then motivates other students.

Within this study context, students' discussions were not always face-to-face. Each group member had different study backgrounds and schedules, which made it difficult to arrange face-to-face group meetings. To overcome this obstacle, they created other communication channels that enabled them to communicate intensively such as Facebook. For future research, it might be useful if information technology can be integrated into the PPBL learning process.

## **5.2 The Centrality of a Real-world Project in PPBL for Sustainability**

Problem and project based learning in sustainability education expects students to be able to work on a real-world project and develop an applicable solution as a learning outcome. In this current study, students were asked to work together with permanent AUT employees who had expertise in as aspect of sustainability and acted as project guides. Brundiers et al. (2010) argue that the involvement of non-academic experts helps students to acquire skills that they cannot get from traditional learning. This is consistent with the findings in this study that students believed that project guides' assistance and support helped them to obtain sustainability related skills such as project planning skills, task organizing skills, network development skills, and negotiation skills. However, Brundiers et al. (2010) do not provide detailed information regarding the types of skills that students might obtain. It is also difficult to find literature in sustainability education or problem and project based literature that describes empirical evidence about this issue. A better understanding of non-academic expertise into the problem and project based learning method is therefore a contribution of this study. For future studies, it would be useful to understand in more detail how best to utilize this expertise (for example, is it best to let project guides discover on-the-job, should they be trained, how often and to what extent would they ideally be involved).

This cooperation was also deemed important by students. Students appreciated the fact that the project guides set aside their time to support students working on the project. It seems that the contribution of non-academic experts toward an affective learning outcome in sustainability education has not become a major interest for many sustainability education scholars. However, Shephard (2008) has put an emphasis in his recent study that it is important to consider the affective domain as a learning outcome in sustainability education. Therefore, this current study supports Shephard (2008) by

providing evidence that it is possible to design collaborative learning methods to achieve an affective outcome.

This study also identifies students' negative perspectives toward non-academic expert involvement. There was an opinion that project guides did not always provide sufficient guidance and information. This might be triggered by an expectation that project guides would supply information for them, just like the traditional role of a tutor in a classroom setting. Therefore, students expected more information and help from project guides. Meanwhile according to the tutor's information, some project guides were working from the assumption not to 'spoon-feed' the students. Brundier et al. (2010) similarly found that students can misunderstand things in an unusual learning environment. Therefore, they need to be provided with a clear expectation related to the role of project guides.

Students perceived that working together on a real-world project was conducive to their sustainability learning. This finding is consistent with several studies in this area. Helle et al. (2007) found that students' intrinsic motivation improved when they worked together on a real-world project in information system design. Similarly, Bas (2011) illustrates that peer interactions in a project based learning environment contributed to better academic performance and positive attitudes.

Moreover, the findings also show that the adoption of a real-world project, in itself, is an effective way to develop sustainability competency. This study has identified skills that are considered important for sustainability expertise, such as analytical skills and basic research skills. The students' main task in problem and project based learning was generating solution for a particular sustainability issue. Therefore, students need to collect and analyze data which is also a part of a research procedure. This finding confirms Savin-Baden's (2000) statement that a real-world project contributes to the development of basic research skills.

In addition, students were required to present their project progress in the class presentation sessions. In these sessions, each group had to present what they had done and they got feedback from other students. This study found that students developed presentation skills through these activities. Similar evidence was found by Savin-Baden (2000). According to Savin-Baden, project-based learning might generate students'

presentation skills. However, this study took a further step forward toward Savin-Baden (2000) by providing more detailed information about the processes involved in how students acquired basic research skills and presentation skills in a problem and project based learning environment.

Another interesting finding is the involvement of students in learning activities to generate solutions for the project improved students' attitudes. Working for a real-world sustainability project provided students with practical experience. Students were able to observe real situations related to the sustainability issue. This kind of learning activity generates students' positive attitudes. Beres' (2011) study also finds a similar result.

Furthermore, a real-world sustainability project was also found to have the ability to improve students' motivation. Learning through a real-world project concentrates on stimulating students' perceptions and assumptions towards a particular sustainability issue. In this way, students might generate stronger awareness and greater motivation. Students become motivated to learn more. This evidence confirms a study by Lam et al. (2009). They argue that students' intrinsic motivation might be developed through a learning process which integrates a real-world project into a class activity.

However, some groups were not enthusiastic to work on a project. Those groups were reported to have low motivation to work, and some did not even complete their projects at the site. Students in these groups were reluctant to meet with the project guides, and the communication between group members was also poor. This study was unable to explain why this situation occurred. It will need further investigation since there are many possible factors, internal to the group, or external (such as the project brief or the project guide) which could cause the occurrence of the problem including the design of the project itself. Further research therefore needs to be done on what types of sustainability problems lend themselves to PPBL, and which ones do not. Sustainability initiatives are, by their very nature, not usually a quick fix. Therefore, it may also be important to adjust students' expectations, in that, on completion of the project they may not have 'fixed' the problem (of for example an overuse of plastic bags on campus).

### **5.3 Role of the Tutor**

This study also found that the tutor had an important contribution to the success of this learning approach. The tutor's scaffolding strategies were identified to positively contribute to affective and cognitive skills development. According to students' statements, the tutor's teaching materials were interesting and useful, and the materials were able to motivate the students to know more about sustainability issues. In addition, the learning strategies adopted such as guest lecturers and reflective writing were also found helpful by most of the participants. Both activities were considered useful in motivating students to gain a deep understanding toward sustainability issues.

The tutor provided students with a range of resources in the scaffold learning process, including teaching materials and instruction methods. The materials given to students included lecture notes, academic journals, and YouTube videos. The contribution of scaffolding in developing students' skills is consistent with findings by Hmelo-Silver et al. (2007) that scaffolding can be used to stimulate students to be involved in learning activities. It also confirms Demetriadis et al. (2008), in that scaffolding methods might improve students' attitudes and motivation. Scaffolding might support students to study in a complex learning environment. However, empirical evidence related to the application of scaffolding with regard to project based learning remains sparse. What type of scaffolding is appropriate to support students to learn in problem and project based learning for sustainability is still unclear. This study indicates with regard to future research that the choice of lecturing materials (whether or not directly pertaining to the projects at hand) is an important motivation in itself.

In this study, the tutor was characterized as being helpful, supportive, easy to talk to, and knowledgeable. Students perceived that the tutor's positive attributes were able to enhance their motivation to learn. The tutor's behaviour and characteristics positively contributed to students' motivation, as supported by studies by Hmelo-Silver (2004) and Lam et al. (2009). Therefore, this study confirms that the tutor's attitude stimulated students' motivation. In summary, this study confirms that both the role of the tutor and that of their project guides is quite central in student learning.

#### **5.4 Benefits for Stakeholders**

The study results also highlight the benefits of problem and project based learning for external stakeholders. This learning method can benefit individual stakeholders (project guides) and their organization as well. Through their activities in helping students work

for a sustainability project, project guides were able to develop students' leadership skills and also help students to understand other people's point of view.

Meanwhile, the benefits for an organization which were revealed from this study were the ability of the organization to build wider networks, which led to possible future business opportunities. Another finding shows that the involvement of an organization in the learning process was an opportunity for the organization to execute a long-planned project that had not been run before. However, data and literature on this area remains sparse. Most literature about problem and project based or education for sustainability addresses this issue from a different interest. They tend to approach this issue from the perspective of students' benefits rather than the stakeholders' benefits. Future studies in this area are considered important in order to attract more stakeholders to cooperate in sustainability education. The future studies would need to present evidence of the benefits that stakeholders might get.

## **5.5 Conclusion**

The purpose of this study was to conduct an evaluation of the learning outcomes from a sustainability course implementing problem and project based method. Therefore, this study intended to answer the following questions:

1. How effective is the PPBL method in developing students' attitudes, motivations, and skills toward sustainability?
  - How do group discussions and class feedback on projects contribute to students' attitudes, motivations, and skills towards sustainability?
  - How do external expertise and the project contribute to students' attitudes, motivations, and skills towards sustainability?
  - How does the tutor scaffolding method affect students' attitudes, motivations, and skills towards sustainability?
2. How valuable is the experience of being involved in the sustainability course for external stakeholders?

The conclusion drawn from this study is that the problem and project based learning method can be considered as an effective method to develop students' attitudes, motivations, and skills toward sustainability. Students perceived that group diversity had a significant effect on their attitudes, motivations, and skills development. Students

also found that group information processing activities were important in knowledge and behaviour development.

The involvement of external experts or non-academic stakeholders in the learning process was considered helpful to improve students' attitudes, motivations, and skills toward sustainability. Students perceived that the interactions between students-external experts were the main reason for knowledge and behaviour improvement. According to students' statements, they were able to develop important skills such as organization skills, negotiation skills, and project planning skills. Moreover, the practical experience that students obtained from the project seemed to be able to help students improve their attitudes and motivation. Practical experiences were also found to be able to develop students' basic research skills, improve students' awareness, and help students to improve the ability to express their ideas.

Another interesting finding from this study is that the role of the tutor is still important in an active learning environment. The tutor's teaching resources and characteristics have a significant contribution in developing students' attitudes, motivations, and skills. The tutor's teaching resources can scaffold student learning. This pedagogy is also considered valuable for external stakeholders who are involved in the learning process. However, several aspects should be given more attention in order to improve the outcome.

The problem and project based method is a complex pedagogy; therefore, faculty members should be well-prepared to run the course. Projects should be designed properly. When faculty members intend to involve non-academic stakeholders in the learning process, the roles of the tutor and stakeholders should be determined in providing scaffolding for students.

## **5.6 Limitations and Future Direction**

Several limitations are identified in this study. The number of students who participated in this study is considered small; only 4 out of 26 students agreed to participate. All participants – students, project guides, and the tutor - were female. However, this study did not intend to look at the issue from a gender perspective. Furthermore, data was collected based on the students', the project guides', and the tutor's perception.

Several issues are considered important to be explored in detail in future studies. Firstly, there is the issue related to the influence of group diversity toward the learning outcome. As has been described above, group diversity in prior skills contributes to the development of task distribution skills, and group diversity in personality/cultural aspects contributes to the development of cultural skills. It is therefore important to further study how group dynamics can be enhanced, particularly with regard to sustainability skills such as closely observing the future one is trying to create. In addition, the group-project guide dynamic has not been studied and was found to be very important in students gaining a number of sustainability competencies. At a time where universities are increasingly used as living laboratories, this dynamic provides rich avenues for future studies.

The involvement of non-academic expertise in problem and project based learning for sustainability is still in its infancy. Studies in this area are still very limited. An important area which needs to be studied further is related to the benefits of the integration of non-academic stakeholders in problem and project based learning in developing students' attitudes and motivation toward the sustainability issue. It is also important to study its impact toward behavioural change.

Thirdly, studies should be conducted related to project designs which might improve the motivation of business school students. It is essential to understand about project characteristics in the sustainability area which can stimulate business students' intrinsic motivation. The role of a project is very crucial in developing students' attitudes and motivation; however, empirical evidence is still greatly lacking.

Fourthly, while clearly a number of scaffolding processes were working for students, the exact nature of the scaffolding process in problem and project based learning for sustainability remains unclear, particularly the issue related to the type of scaffolding which might be considered effective in developing student sustainability competency. Further studies need to address this area, since the problem and project based method is a complicated pedagogy which needs a scaffolding strategy to support student learning.

The last recommendation for further study is about the benefits of a problem and project based method toward an organization, including external stakeholders who are engaged in the learning process. Studies in this field need to be conducted in order to provide

evidence for stakeholders about the benefits that they might acquire and ensure ongoing campus research in pedagogical approaches such as evidenced in this study.

## APPENDIX A

### ETHICS APPROVAL



#### AUTEC Secretariat

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**AUT**

17 December 2015

Marjolein Lips-Wiersma  
Faculty of Business and Law

Dear Marjolein

Re Ethics Application: **15/427 Problem and project based learning in sustainability enterprise management: Exploration of student cognitive and affective skills.**

Thank you for providing evidence as requested, which satisfies the points raised by the Auckland University of Technology Ethics Committee (AUTEC).

Your ethics application has been approved for three years until 17 December 2018.

As part of the ethics approval process, you are required to submit the following to AUTEC:

- A brief annual progress report using form EA2, which is available online through <http://www.aut.ac.nz/researchethics>. When necessary this form may also be used to request an extension of the approval at least one month prior to its expiry on 17 December 2018;
- A brief report on the status of the project using form EA3, which is available online through <http://www.aut.ac.nz/researchethics>. This report is to be submitted either when the approval expires on 17 December 2018 or on completion of the project.

It is a condition of approval that AUTEC is notified of any adverse events or if the research does not commence. AUTEC approval needs to be sought for any alteration to the research, including any alteration of or addition to any documents that are provided to participants. You are responsible for ensuring that research undertaken under this approval occurs within the parameters outlined in the approved application.

AUTEC grants ethical approval only. If you require management approval from an institution or organisation for your research, then you will need to obtain this.

To enable us to provide you with efficient service, please use the application number and study title in all correspondence with us. If you have any enquiries about this application, or anything else, please do contact us at [ethics@aut.ac.nz](mailto:ethics@aut.ac.nz).

All the very best with your research,

Kate O'Connor  
Executive Secretary  
Auckland University of Technology Ethics Committee

Cc: Vidayana Soebagio [jaruki21@yahoo.co.id](mailto:jaruki21@yahoo.co.id)

## APPENDIX B

### PARTICIPANT INFORMATION SHEET

#### Participant Information Sheet



Date Information Sheet Produced: 21 October 2015

Project Title: SUSE346000 applied project

#### An Invitation

My name is Vidayana Soebagio,(Vida). I am a master's student at AUT. I would like to invite you to take part in a research project that I am doing for my qualification.

It is important for you to know that:

- your participation is completely voluntary,
- whether you choose to participate or not will not affect your marks or other opportunities at AUT in any way,
- no-one AUT, including the project supervisor (Marjo), will be given a list of who has participated,
- what you tell me will only be reported in aggregated form (in other words, no individual student stories will be able to be identified).

#### What is the purpose of this research?

The purpose of the research is to find out how to best do an applied sustainability project in a University setting. In order to establish this, the researcher will talk to several stakeholders such as the project guides, their managers, the lecturers involved and of course the students.

#### How was I identified and why am I being invited to participate in this research?

You are being invited to take part in this research because you are a student who has participated in an applied sustainability project at AUT.

#### What will happen in this research?

I will talk to you one to one and ask you questions. The discussions will be audio recorded. After our discussion I will transcribe the recording and, if you want to, I will give you a written copy of the discussion and give you the opportunity to give me feedback, to make sure I have recorded what you said correctly. Once I have all the individual discussions transcribed I will analyse all the information as a whole. If I have your permission, I will also do content analysis on your SUSE 346000 reflection assignments.

#### What are the discomforts and risks?

The chance of any discomfort and risk to you is low. I expect each discussion to take about 25 minutes and we can do these discussions in a manner (Skype, face to face, phone) that is convenient to you. I will ask you to tell me about your own experiences with the applied sustainability project, what you learned, what worked and ideas you may have to improve it. You can refuse to answer any questions you don't want to answer. You can ask for us to finish the discussion at any time if you don't want to continue.

#### What are the benefits?

This is an opportunity for you to have an input into academic research that aims to improve the learning outcomes of the AUT sustainability degree.

#### How will my privacy be protected?

Your contact is directly with me. Your lecturers will not get any information to say who has or has not participated in this research from me. What you say to me is confidential to me and my supervisor will only get aggregated data. Any identifiable information (for example which project group you were part of) will be removed from the transcripts. This means that we separate your name from your answers so there will be no way for anyone else to identify what your answers were. Your name will never appear anywhere when I use the results from these discussions.

**How do I agree to participate in this research?**

You will be asked to identify your intention to consent by signing the form. If you have changed your mind by the time I contact you in a couple of weeks' time, this is no problem at all.

**What happens with this research?**

The findings of this research will be included in a Master's thesis which I will submit. The information, in a condensed form, will be used for academic and practical publications (e.g. reports, research papers, journal articles) and presentations (e.g. conference presentations, academic presentations). This research will also be presented, in a summarised form, to AUT.

**Will I receive feedback on the results of this research?**

Once I have analysed the data, I will write a one to two page summary of my findings. These will be given to you.

**What do I do if I have concerns about this research?**

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, Professor Marjolein Lips-Wiersma, [marjo.lips-wiersma@aut.ac.nz](mailto:marjo.lips-wiersma@aut.ac.nz) Phone: +64 09 921 9999 ext5038

Concerns regarding the conduct of the research should be notified to the Executive Secretary of AUTEC, Kate O'Connor, [ethics@aut.ac.nz](mailto:ethics@aut.ac.nz), +64 921 9999 ext 6038.

**Whom do I contact for further information about this research?**

**Researcher contact detail**

Vidayana Soebagio , jaruki21@yahoo.co.id

**Supervisor contact detail**

Professor Marjolein Lips-Wiersma, [marjo.lips-wiersma@aut.ac.nz](mailto:marjo.lips-wiersma@aut.ac.nz)

Approved by the Auckland University of Technology Ethics Committee on 17 December 2015, AUTEC Reference number 15/427

## APPENDIX C

### PARTICIPATION INTENTION FORM



#### Participation Intention Form

*Project title:* Advantages and Drawbacks of applied project learning

*Project Supervisor:* Professor Marjolein Lips-Wiersma

*Researcher:* Vidayana Soebagio

- I have read and understood the information provided about this research project in the Information Sheet dated 21 October 2015.
- I understand that taking part in this research is voluntary.
- I have had an opportunity to ask questions and to have them answered.
- I understand that notes will be taken during the interviews and that they will also be audio-recorded and transcribed.
- I understand that I may withdraw myself or any information that I have provided for this project at any time prior to completion of data collection, without being disadvantaged in any way.
- If I withdraw, I understand that all relevant information including recordings and transcripts, or parts thereof, will be destroyed.
- I agree to take part in this research.
- I give permission for Vida to do a content analysis on my SUSE 346000 Reflection Assignments: (please tick one): Yes No
- I wish to receive a copy of the report from the research (please tick one): Yes No

Participant's signature: .....

Participant's name: .....

Participant's Contact Details:

.....  
.....  
.....  
.....

Date:

*Approved by the Auckland University of Technology Ethics Committee on 17 December 2015 AUTEC Reference number 15/427*

*Note: The Participant should retain a copy of this form*

## **APPENDIX D**

### **INTERVIEW QUESTIONS**

#### **Question for Student**

1. Ice breaker: Please tell me about your project in the Sustainability class?
2. How did you like working in a group?
  - a. Do you think by doing the project, it is more effective to your learning of Sustainability? Do you think you learn more or less?
  - b. Can you tell me what you like most about this learning experience?
  - c. Can you tell me what you don't like about this learning experience?
3. How do you think the learning method affect your motivation?
  - a. Your motivation to know more about Sustainability in terms of knowledge/information?
  - b. Your motivation to do the assessments required or to join the activities set?
4. How do you think learning by doing real world project affect your interest in sustainability issues?
5. Have you experienced changes in your own attitudes towards sustainability issues after taking the class? How do you think learning sustainability by project contribute to that change?
6. How does, if any, has sustainability course affected your daily life?
7. What skills do you think you have gained from your experience in this class?
  - a. Skills related to sustainability?
  - b. Other skills?
  - c. How do you think the project-based learning contribute to that skills achievement?
8. How has the project supervisor help your group learning activities?
  - a. Do you find the expertise of the project supervisor helpful?
  - b. Do you find the interaction with the project supervisor help you? Was your relationship effective to achieve the goal?
9. How helpful was the lecturer in assisting your learning?
  - a. Do you think lecturer instruction helped to support your individual / group learning?
  - b. How has the reflection that you made influenced your learning?
10. If you can change how this course was delivered, what would you change?

#### **Questions for Project Guide**

1. Ice breaker: Please tell me about your project in the Sustainability class? Can you describe your role in SUSE 346000.
2. When you were recruited to supervise this project, what do you think was expected from you? How was the reality in the field, was there a gap between what you think was expected from you and what really happened?
3. What did you expect from the students during this project in terms of attitude and motivation? Was the expectation met?
4. Do you think the project you supervised is suitable to achieve the cognitive learning outcomes outlined?

5. Did you see any interesting fact about the student while they were working together?
6. What have the students gained from learning through this project?
  - a. In terms of sustainable knowledge?
  - b. In terms of awareness of sustainability issues?
  - c. In terms of attitudes towards sustainability?
  - d. In terms of their motivation to learn more about sustainability?
7. Can students use what they've learned
8. How has the classroom "culture" changed as a result of project work?
9. How valuable was this experience for you? Would you do it again?
10. If you can change how this course was delivered, what would you change?

### **Question for Lecturer**

1. Could you tell me why did you decide to deliver the course using PPBL method?
2. Did you have any expectation regarding to this new teaching method? Did your expectation meet
3. Could you tell me any unanticipated outcomes of the PPBL experience?
4. How reliable the PPBL that has been set up on students' achievement?
5. How did students use what they've learned?
6. Could you tell any interesting fact / phenomena related to the student while they were working in group?
7. Could you tell about the influence of project work to individual learners?
8. How did the PBL affect students' motivation:
  - a. To finish their assignments?
  - b. To learn more about sustainability issues?
9. Do you think delivering the sustainability course using PPBL are affecting students' attitudes and behaviors?
10. From your perspective, how would you describe students' interest in sustainability?
11. Could you tell me the benefits of PPBL for engaging and fostering the achievement of low-achieving students and for reducing the gap in achievement levels?

**APPENDIX E**  
**EXAMPLE OF DATA MATRIX**

Research Question	Student Interview	Reflection Document	Project Guide Interview	Tutor Interview
RQ.1a. How does group discussion and class feedback on projects contribute to students' attitude, motivation and skills towards sustainability?	<p>We had to find time to make sure that we were discussing whatever our plans were going forward with the communication plan (RSP 03)</p> <p><b>Code :</b> Communication</p> <p>I've done that, I've been overseas and negotiated with German on business but even so,(RSP01).</p> <p><b>Code:</b> Skills Differences</p>	<p>When we brainstormed ideas for the content plan we all had different ideas which allowed us to come up with a diverse range of ideas from our ability to collaborate. (DocRSP04)</p> <p><b>Code:</b> Concept consolidation</p> <p>acknowledge how imperative it is to communicate effectively with members of the group to ensure that tasks are understood and followed through as well as deadlines and project expectations are met (DocRSP03).</p> <p><b>Code:</b> Communication</p>	<p>So then there had to be a bit of reconciling of different information to figure out, ok, given this imperfect situation, what's going to be the best outcome? I think some of the groups really encountered that and it's a really useful experience for them (PG01).</p> <p><b>Code :</b> Concept consolidation</p> <p>I don't think they communicated with each other very well either because I would have one person emailed me for something that I supplied another group member (PG2).</p> <p>Code: Communication</p>	<p>it felt to me that second year students are still a bit too young or too inexperienced rather, to just say well go out there in the world and find a project to work on (TR01)</p> <p><b>Code:</b> Skill Difference</p>
RQ.1b. How do external expertise and the project contribute to students'	Because it teaches you to be more careful when you do your negotiation, yeah, it teaches you a whole	Project guide (*name edited) recommended, engaged us and showed us examples to research	They've got the experience of trying to do stakeholder	I think they got realistic about what the job of a sustainability manager entails, in a positive way

attitude, motivation and skills towards sustainability?	<p>bunch of skills I think, yeah. (RSP01).</p> <p><b>Code:</b> Cooperation</p> <p>We all did a bit of everything -(RSP02)</p> <p><b>Code:</b> Collaboration</p>	<p>structure and how to divide into subtasks. (DosRSP01)</p> <p><b>Code:</b> Cooperation</p> <p>The learning so far from this paper and the project we are working on, namely, the Communications Plan has been an interesting and challenging course of events (DocRSP03).</p> <p><b>Code:</b> Challenge</p>	<p>engagement with someone (PG01)</p> <p><b>Code:</b> Cooperation</p> <p>one of the students actually went and rented a electric bike for a day just to see what that would be like and then showed the other group members; they all had an experience with it to see what it was like (PG01)</p> <p><b>Code:</b> Practical experience</p>	<p>of yes you can actually change things (TR)</p> <p><b>Code:</b> Cooperation</p> <p>I also think looking back what was really important in the whole process was their project brief, you know, that became quite clear. Some students were a bit too organic, like they sort of glanced at the project brief and then they just charged off and decided to do their own thing (TR)</p> <p><b>Code:</b> Practical Experience</p>
RQ.1c.How does tutor scaffolding method affect students' attitude, motivation and skills towards sustainability?	<p>It (writing reflection) probably made me keep track of how I'm improving personally. Yeah, I did notice that I was like, oh, I've improved from that, I'm learning, I didn't actually reflect and realize I was doing that (RSP02)</p> <p><b>Code:</b> Instructional Activities</p> <p>and she did give us questions and material,</p>	<p>Having done the exam I must say there is a great of knowledge to bear in mind and effectively use and apply to projects (DocRSP03)</p> <p><b>Code:</b> Teaching Materials</p> <p>I appreciated all feedback, as this is key to learning during the process. For examples taking in feedback from Marjo regarding taking too much</p>		

	<p>you know like your typical kinda theories, I think one CD, one online CD, it taught us about how to download it, to research it (RSP01)</p> <p><b>Code:</b> Teaching Materials</p>	<p>on and doing jobs for other people (DocRSp01)</p> <p><b>Code:</b> Assistance</p>		
RQ.2.How valuable is the experience of being involved in the sustainability course for the external stakeholders?		<p>I found valuable was being able to then e.g. the battery recycling project being able to then give that to staff and say, well, the students have identified that this organization would be good to use for battery recycling so it meant that I wasn't necessarily having to do that work 'cos it's got to be (PG01).</p> <p><b>Code:</b> Executer Organization Plan</p> <p>So I think what I learnt from my experience, it was really good in terms of having interaction with students and seeing the students experience being involved in a sustainability project and being involved in</p>	<p>it gives them some insight into what people's roles are, you know, they might decide they want to do sustainability communications, as one of the students did,(TR01)</p> <p><b>Code:</b> Learning Other Perspective</p> <p>Yes, and I think we make a lot more connections in this way (TR)</p> <p><b>Code:</b> Network</p>	

			<p>the implementation side of it and gaining a greater level of understanding about what's actually required, (PG01)</p> <p><b>Code:</b> Learning other perspective</p>	
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**APPENDIX F**  
**TRIANGULATION TABLE**

	Themes	Codes	Students Interviews	Reflection Documents	Project guides Interviews	Tutor Interview
RQ1a	Group Diversity	Skill Differences	yes	yes	no	yes
		Personal/cultural differences	yes	no	no	no
	Exchange Information	Communication	yes	yes	yes	no
		Concept consolidation	yes	yes	yes	no
RQ1b	Social Interaction	Cooperation	yes	yes	yes	yes
		Collaboration	yes	yes	yes	no
	Active Learning	Practical Experience	yes	yes	yes	yes
		Expressing Idea	yes	yes	yes	yes
		Information Gathering	yes	yes	yes	no
		Challenge	yes	yes	yes	no
RQ1c	Teaching Resources	Teaching Materials	yes	yes	no	no
		Instructional Activities	yes	yes	no	no
	Lecture Character	Assistance	yes	no	no	no
		Knowledgeable	yes	no	no	no
RQ2	Organization development	Execute Organization Plan	yes	no	yes	no
		Network	no	no	yes	yes
	Personal development	Leadership	no	no	yes	yes
		Learning other perspective	no	no	yes	yes

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