

Developing a Sustainability Mindset in a Sustainable Supply Chain Management Course

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Abstract

This paper presents an explorative case study for developing a sustainable supply chain management course (“Sustainable and Global Supply Management”, MS in Management Engineering, University of Bergamo, Italy), using a unique and new combination of pedagogical approaches. Various exercises aligned with Kolb’s experiential learning method were used to enhance learning and stimulate the Sustainability Mindset (SM) development. The choice of exercises was flexibly and intentionally designed based on results of the Sustainability Mindset Indicator (SMI[®]), an assessment of students’ position towards the SM. A pre-post analysis employing the SMI[®] allowed determining the effects of the experiential teaching methods.

Keywords: sustainability mindset, sustainable supply chain management, experiential learning

Introduction

The latest report of the Intergovernmental Panel for Climate Change (IPCC, 2022) indicates that current efforts to reduce human-caused impact on climate change fall short. This is just one example of increasing evidence that anthropogenic activities are increasingly endangering the planet's natural balance. Of course, frameworks to counter this development exist. Polman and Winston (2021) suggest a new business dogma, “net positive”, and argue that businesses must give more to the world than they take. The United Nations (UN) 2030 Agenda for Sustainability formulates seventeen Sustainable Development Goals (SDGs) that formalize targets that governments, organizations and individuals can pursue. Such profound transformations require a change in mindset for leaders and clear public commitment (Davis-Peccour et al., 2017). Rimanoczy and Llamazares (2021) advance a needed paradigm shift away from rationalism and competitive individualism, a new mindset as a prerequisite for leaders and individuals to leave anthropogenic views behind and to develop into caretakers of the planet and our societies (Rimanoczy, 2021a). Resulting from studying leaders that advanced their

organizations towards sustainability, the Sustainability Mindset and its twelve principle, represents a framework that allows for the intentional development of a mindset for sustainability in education and training (Rimanoczy, 2010 and 2021b). Recently, the Sustainability Mindset Indicator (SMI[®]; Rimanoczy and Klingenberg, 2021) was added as an assessment tool that maps an individual's pathway towards such mindset and explores in pre-post comparison how teaching or training may contribute to the development of the mindset.

Similarly, this need for a paradigm shift is reflected in teaching by the experiential learning theory developed by Kolb (1976, 1984), which challenges the traditional teaching and learning methods.

Taking the case of a sustainable supply chain management course from October to December 2022, this paper reports on the results of the pre-post assessment, mapping outcomes to various teaching interventions employed throughout the course, under the lens of Kolb's (1976, 1984) experiential learning model. In particular, this paper aims to show how it is possible to design a course to teach sustainable development-related topics covering all the phases of Kolb's experiential learning cycle, so contributing to creating multiple types of knowledge. Besides recognizing and applying the four phases of the cycle proposed by Kolb, the literature lacks ways of assessing the knowledge students need the most, leaving room to adapt the teaching tools and methods applied.

Therefore, the research question the paper addresses is the following: *How can the experiential cycle be dynamically adapted to address specific knowledge needs?*

This research is the first exploratory study into the use of the SMI[®] as an assessment tool to study the effectiveness of intentional teaching approaches towards the Sustainability Mindset. Furthermore, the paper presents insights for the effectiveness of teaching approaches, specifically through experiential learning frameworks. As such, this research contributes to the body of literature on teaching approaches for sustainable development, showing the relevance of mixing technical, experiential, as well as emotional learning, to increase teaching effectiveness.

Theoretical Frameworks

Experiential Learning Theory

Experiential learning was introduced by Kolb more than forty years ago (Kolb, 1976,1984) and is today a well-established pedagogical approach: a recent meta-analysis of studies on the importance and effectiveness of experiential learning (Burch et al., 2019) found that students exposed to this method experienced superior learning outcomes. In the context of teaching sustainability, Savage et al. (2015) report that students in a sustainability leadership course were excited about experiential learning methods and had gained considerable competences, particularly through exercises for personal development. Sulkowski et al. (2020) used the experience of creating sustainability reports as a successful tool to enhance student learning, while Dieleman and Huisingh (2006) make the case that experiential learning through games play an important role in building knowledge, skills, and attitudes relevant to capable change agents that support the paradigm shift and transition towards sustainability.

Kolb's experiential learning model is rooted in neurosciences: different parts of the brain support different types of learning, namely sensing, remembering, theorizing, and acting (Zull, 2002). Respectively, learning is then described by Kolb as a continuous cycle of four phases: experiencing, reflecting, thinking, and acting (Kolb and Kolb, 2018). The cycle starts with experiencing, the assimilative sensing function, resulting in assimilative knowledge (sense-making of experiences through apprehension intention, Dieleman and Huisingh, 2006). The more concrete the experiences during this phase are (vs abstract

principles), or the more surprising or provoking to let go of conservative and automatic “everyday” experience, the more effective the learning is (Kolb & Kolb, 2018). Hence, it is not routine experiencing but what are called “pure” experiences (James, 1977) or “shocks” that interrupt normality and trigger reflection that can lead to learning that changes behavior. The second step is reflective observation or remembering (Kolb & Kolb, 2018), which creates accommodative knowledge through comprehension intention (Dieleman & Huisingh, 2006) and adapts the knowledge gained through experience to new contexts. Comprehension extension creates convergent knowledge through abstract conceptualization (Dieleman & Huisingh, 2006). This thinking or theorizing phase comprises interpretation and analysis, leading to symbolic representation, in other words, the ability to turn information into knowledge that can then be applied within the original context (Dieleman & Huisingh, 2006). Lastly, apprehension extension leads through active experimentation to divergent knowledge, which enables the learner to adapt the knowledge to new contexts: the acting or active experimentation phase (Kolb & Kolb, 2018). The cycle restarts as active experimentation leads to new, concrete experiences.

The Sustainability Mindset and the Sustainability Mindset Indicator

The Sustainability Mindset is a framework introduced by Rimanoczy (2010, 2021b). It is rooted in the following reasoning: as Cronin (2017) coined the term “Age of the Anthropocene”, recognizing the ever-more visible human impact on the complex ecological planetary systems, and faced with a multitude of global, ecological and social crises, it seems that even with a plenitude of early warnings (see e.g., Carson, 1962; Meadows et al., 1972; Anderson et al., 2016), surprisingly few significant changes to business models or ways of living have been made. Sticking out of what seems to be a deep-rooted complacency, some leaders are acting, converting their businesses to more sustainable ones. Taking the angle of Appreciative Inquiry (Cooperrider et al., 2008) and Positive Psychology (Seligman & Csikszentmihalyi, 2014), Rimanoczy’s research intended to learn from these leaders’ successes, with the objective to develop a framework for higher education to intentionally develop environmentally and socially responsible global citizen (Rimanoczy, 2010). Key components were the consideration of which information changed leaders’ behavior, how they analyzed it and what motivated unusual steps to change their businesses. This work allowed describing how a mindset for sustainability could look like: a way of thinking and being, as a result of understanding of the ecosystem, developing social sensitivity, and an introspective view on purpose and personal values. The Sustainability Mindset comprises four content areas: ecological worldview, systems thinking, spiritual and emotional intelligence. These content areas are furthermore divided into what became the twelve Sustainability Mindset Principles (SMPs), see Table 1.

Table 1: The Sustainability Mindset and its twelve principles (Rimanoczy, 2021b).

Content Area	Principles
Ecological World View	Ecoliteracy, My Contribution
Systems Thinking	Long-term thinking, Both-And, Flow in Cycles, Interconnectedness
Emotional Intelligence	Self-Awareness, Reflection, Creative Innovation
Spiritual Intelligence	Oneness with Nature, Mindfulness, Purpose

Based on this framework, an online-based assessment tool was developed that maps where an individual stands regarding the development of the Sustainability Mindset (Rimanoczy and Klingenberg, 2021). Using Johnson’s (1992) framework of polarities as

well as Kegan’s (1994) framework of stages of human development, a Sustainability Mindset Indicator (SMI®) was created as a personal development tool. Through thirty-six contrary statements, it captures the development of the Sustainability Mindset compared to a conventional mindset of the cognitive, behavioral and affective dimensions of each of the twelve principles (Rimanoczy and Klingenberg, 2021). Participants receive an approximately thirty pages long personal development report, which again builds upon the concepts of Positive Psychology (Seligman & Csikszentmihalyi, 2014) and Appreciative Inquiry (Cooperrider et al., 2008). Furthermore, instructors receive an anonymous aggregate report that shows how the Sustainability Mindset is developed across the group. This report allows for identifying weaker developed principles as well as which of the dimensions (cognitive, behavioral or affective) is lacking (Rimanoczy and Klingenberg, 2021). Leveraging this information, educators can then identify specific interventions or exercises that encourage considering these principles with various experiential learning approaches (Rimanoczy, 2022). Finally, the SMI® allows for a pre-post analysis: participants can re-take the assessment tool, and the instructor receives a comparative report. While this report does not allow for cause-and-effect analysis of interventions taken and mindset changes, as the participants are not isolated from other experiences in their everyday lives, it does provide a picture of personal development within the group during the period of e.g., a course during which the SMI® was used (Rimanoczy and Klingenberg, 2021).

Course Design

The objectives of this study were achieved by using as a case study the course on Sustainable Supply Chain Management provided to students in the second year of the Master’s degree program in Management Engineering of the University of Bergamo (Italy). The course recognizes to the students 6 ECTS upon completion of the final exam that can be taken in two modes: as attending student, which means following 48 hours of in-class activities, delivering all the intermediate assignments, and participating in two group projects; or as non-attending student, which means taking an oral exam by preparing all the material provided in-class plus additional readings. The course was delivered for the first time in October-December 2022 and three educators were involved in the teaching activities, as well as in the evaluation of the students. All the attending students were also assessed in terms of their proactiveness during the lectures. In total, 37 students took part in the course, and Figure 1 reports their distribution in terms of participation.

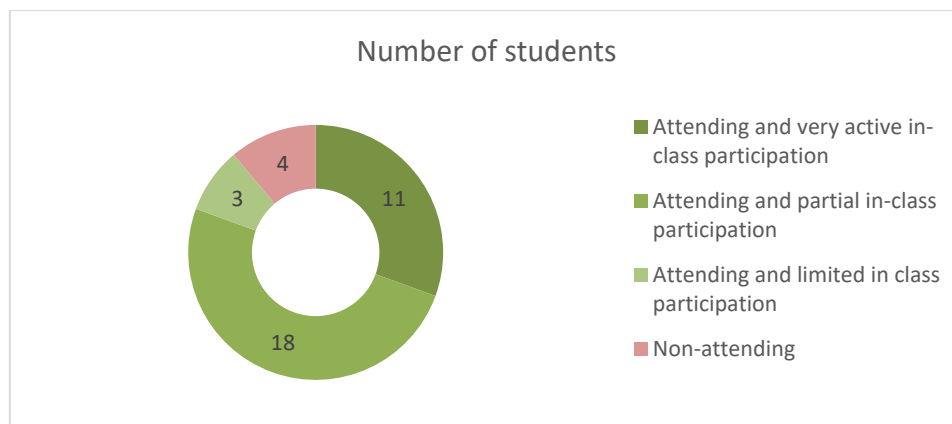


Figure 1: Distribution of the students in terms of participation in the course

The course was designed in terms of general contents and modules by one of the researchers, with the support and feedback of other colleagues, starting almost one year before the course delivery. This period was needed to identify potential tools, educational instruments and artefacts to be used along the course by participating in teaching sessions at conferences and benchmarking similar courses. Moreover, all the teachers had the chance to train themselves with the tools that were planned to be used along the course. For example, two of the educators received training for the simulation tool that was then used to teach the students the systemic view behind the circular economy. Other two educators instead received the training to understand the Sustainability Mindset Principles. Finally, one of the educators was the ideator of the SMI[®], to make sure that a complete and rigorous interpretation could have been given real time to the students. This process of continuous learning and improvement enacted by the three educators involved in the course design resulted in an initial course structure that included the following modules:

- 1) Introduction to sustainability and sustainable supply chain management
- 2) The internal perspective of the company
- 3) The Sustainability Mindset Principles
- 4) The upstream perspective of the supply chain
- 5) The circular economy
- 6) Global supply chain management
- 7) The social side of sustainability

All the modules were designed in order to include multiple teaching approaches and, when possible, all the four phases of Kolb's experiential learning cycle in order to support the creation of all the four types of knowledge.

Table 2 reports the eight modules and the tools used to contribute to the four phases of the experiential learning cycle. Moreover, the table also reports how we aimed at assessing all four types of knowledge acquired.

Learning Cycles and Assessment

Following Kolb's experiential learning cycle, the intent was to start the course with a concrete experience that triggers assimilative learning. The SMI[®] was chosen: taking into consideration that the students participating in the course had no prior, formal introduction to the concept of sustainability, and given the thought-provoking nature of the thirty-six contrary statements, the instructors deemed the administering of this tool to have the potential of being a "pure" experience James (1977) called for. Considering the statement pairs and finding the one that reflects a person's current state of mind requires by itself a deeper questioning and reflection of self and one's values.

While the general flow of topics covered in the course was set up front, the instructors then considered the results provided by the instructor report to dynamically choose interventions that would result in reflection, thinking, acting, and again experiencing, following Kolb's learning cycle. In the following, some examples are presented.

Figure 2 shows one of the graphs of the instructor report, which indicates the aggregate development of the Sustainability Mindset, assessed before the start of the course.

Table 2: Details of the course modules and relation with Kolb's experiential learning cycle

	Experiencing (assimilative knowledge)	Reflecting (acomodative knowledge)	Thinking (convergent knowledge)	Acting (divergent knowledge)
1) Introduction to sustainability and SSCM	Taking the SMI®	Looking at the results from the report	Lectures on sustainability and SSCM	
2) The internal perspective of the company	Reporting recent news on the topics of the lectures	Writing an individual essay including the topic of the module	Lectures on reporting, CSR, SDGs, Change management	Development of a group project work by interacting with a real company
3) The Sustainability Mindset principles	Various experiential exercises	Stop-Reflect approach	Lecture on the Sustainability Mindset principles	Retaking the SMI® and reflecting on the changes
4) The upstream perspective of the supply chain	Reporting recent news on the topics of the lectures	Writing an individual essay including the topic of the module	Lectures on supply chain design, traceability, codes of conduct	Development of a group project work by interacting with a real company
5) The circular economy	Simulation on circular economy	Writing a group report explaining the results obtained from the simulation	Lectures on circular economy	Development of a group project work by interacting with a real company
6) Global supply chain management	Reporting recent news on the topics of the lectures	Writing an individual essay including the topic of the module	Lecture on global supply chain management	In-class debate on why a global supply chain can be considered sustainable or not
7) The social side of sustainability	Showing videos of modern slavery cases (e.g., Shein, Leicester)	Writing an individual essay including the topic of the module	Seminar on social sustainability and modern slavery	
Evaluation of the acquired knowledge	Results of the circular economy simulation	Group report of the circular economy simulation; Individual essay (to include all the modules topics)	In-class participation (as a bonus)	Group project work with companies

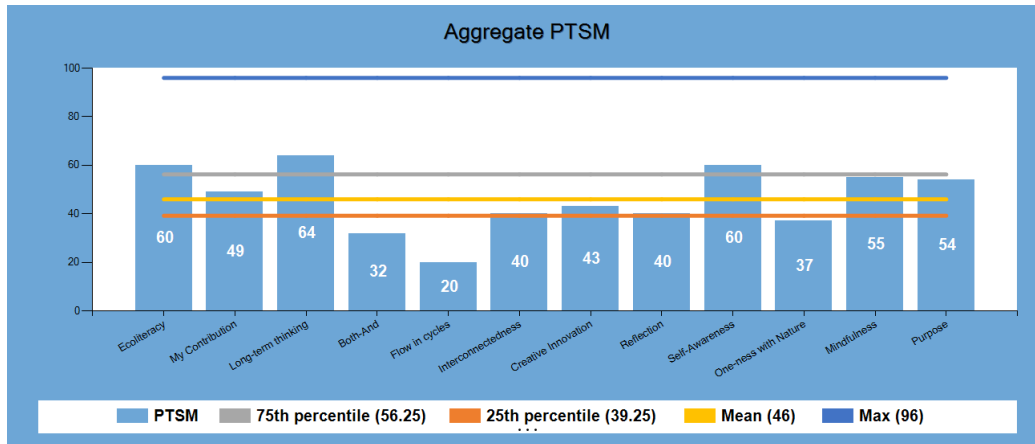


Figure 2: Aggregate Points towards the Sustainability Mindset (PTSM). Source: SMI®.

The graph indicates that the maximum possible score towards the Sustainability Mindset (Points towards the Sustainability Mindset, PTSM) is approximately 100 (the exact number is the result of the number of participants), while the mean of the achieved points is 46. The principles that are weakly developed are Both-And, Flow in Cycles, Oneness with Nature, Interconnectedness and Reflection.

Throughout the course, a method called “Stop-Reflect” (Rimanoczy and Turner, 2012; Turner; 2013) was often used. Students were asked to take a few minutes to consider a topic discussed, an exercise, or, at the beginning, their experience of completing the SMI®. This practice encouraged two developments: in line with Kolb’s learning cycle, experiencing is followed by active reflecting, to convert assimilative into accommodative knowledge. Furthermore, it also provided practice for the Sustainability Mindset Principle of Reflection.

Examples of interventions to develop Interconnectedness

Taking the example of Interconnectedness, the following interventions were employed:

- 1) Dragon and Protector: This is an experiential learning intervention in which all participants mix in an open room. Each person picks a “dragon”, meaning a person to be as far away from as possible and a “protector”, a person to be close to. Who has which role is not disclosed. The exercise generally leads to a continuous movement of participants as they try to move away or get close to a certain person, showing systems dynamics. This exercise again triggered a learning cycle. Reflective observation that followed using a “Stop-Reflect”, allowed students to move the assimilative knowledge of the experience into the realm of accommodative knowledge by the added understanding of systems dynamics. The intervention was aimed at developing the cognitive dimension of Interconnectedness.
- 2) Coffee Cup (Rimanoczy, 2022): Participants are asked to list all people or entities involved in their having a cup of coffee (or beverage of choice). Participants often start with just a hand-full, sometimes just themselves (“I made my coffee.”), however, they soon discover that the list is rather an endless, interconnected system. This exercise adds to the previous by further exploring the systems perspective. From an abstract conceptualization of a system, it also represents an active experimentation in new contexts. Again, the objective was developing the cognitive dimension of Interconnectedness.
- 3) My accomplishment (Rimanoczy, 2022): Participants choose a recent personal accomplishment, and then are asked to reflect upon if others than themselves contributed to this accomplishment. Similar to the Coffee Cup Exercise, the reflection

can trigger the realization that even if an achieved goal feels like something accomplished all by oneself, others did contribute, even though indirectly. This again triggers reflection on the concept of being interconnected, or part of a system, but approaches it from an affective angle, as accomplishments involve a considerable emotional aspect, such as pride, the feeling of being able to succeed and more. The objective was developing the affective dimension of Interconnectedness.

The course included several other of such interventions, targeted to specific principles of the Sustainability Mindset, including a simulation game on Circular Economy (Principle Flow in Cycles), excises for Both-And, Creative Innovation and Oneness with nature. A mandatory and a voluntary reflective essay encouraged moving from assimilate to accommodative knowledge, and a student project involving real companies required to move from abstract conceptualization to active experimentation. A focus group at the end of the course allowed students to express their experiences, learning, intellectual as well as emotional growth and data for the pre-post analysis were collected by asking the participants to repeat the SMI[®] assessment tool.

Pre-Post Assessment

Figure 3 shows a graph from pre-post instructor report.

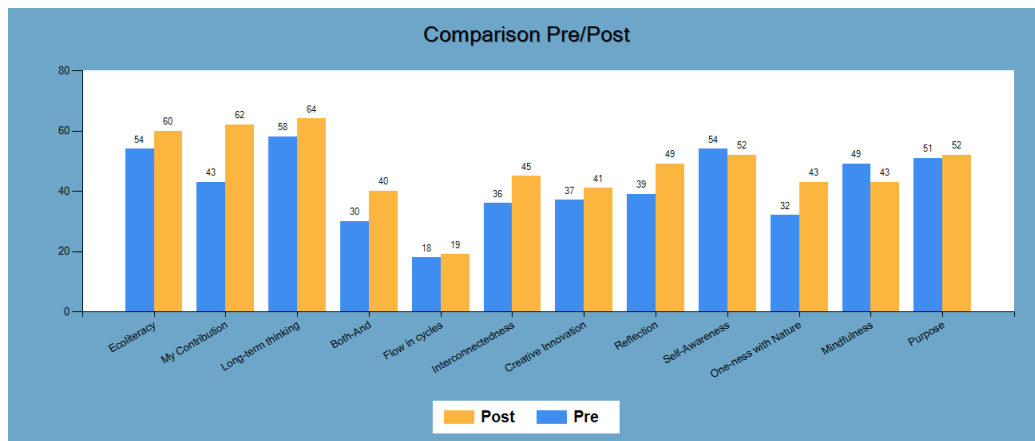


Figure 3: Pre-Post Comparison of aggregate PTSM. Source: SMI[®].

The graph shows how PTSM changed. As not all students participated in this second assessment, the absolute scores should not be compared to the ones in Figure 2. Data was cleaned to include only those with both assessments. Figure 3 shows PTSM increase for most principles (a discussion of the two principles that see declined scores is outside this paper's scope). The two principles discussed in the previous section see percentage increases of: interconnectedness 25%, and reflection 26%, respectively (Source: SMI[®]). Care needs to be taken not to overinterpret this observation. As stated above, the students do not experience the course in isolation, and one cannot exclude that other outside events influenced the students' mindset. However, Figure 3 is testimony to a nascent mindset change that the instructors believe the course contributed to.

Discussion and conclusions

Teaching sustainability challenges educators on several levels, given the interdisciplinary content, the systemic and sometimes even paradoxical nature of sustainability concepts, and the urgency with which multiple ecological and social crisis need to be addressed, which calls for a paradigm shift in our thinking, doing, and business models (Rimanoczy and Llamazares, 2021). Before this background, a course was designed using the SMPs

as frame to encourage thinking processes that explore an ecological worldview, systems thinking, and emotional as well as spiritual intelligence as a guidance towards understanding what sustainability is and how it can be incorporated into business, and specifically, supply chain management solutions. Experiential learning, as introduced by Kolb (1974), was chosen as the pedagogical approach. Experiential exercises and activities were purposely chosen based on the aggregate group results of the SMI[®] that allows for identifying aspects of the Sustainability Mindset that may need further development. Completing the SMI[®] by itself and reflecting on the individual report is a new and profound experience that allowed the students to begin with Kolb's learning cycle's assimilative or experiencing phases.

Encouraging reflective practices throughout the course allowed to continuously inspire moving from the experiencing to the reflecting, and then thinking and acting phase. Looking at the pre-post results of the SMI[®] assessment, it appears that overall, the course contributed to further the intentional development of the SM for the students.

The instructors experienced their own learning cycle by accompanying the students in theirs: observing what happened during exercises, listening to or reading reflections and observing how learning of traditional material together with the personal growth offered by the course shaped new ways of thinking and innovative ideas on the side of the students provided a rich experience in itself, as well as reflective moments to observe the impact of the teaching method. Continuously observing the course and adapting teaching to how the group developed enforced and re-enforced the joint learning of the SM.

In summary, we believe that the unique and, to the best of our knowledge, new combination of Kolb's experiential learning method and the Sustainability Mindset, together with the specific results of the SMI[®], enabled the creation of a rich and inspirational learning environment that furthers learning of and about sustainability, its implications, and applications. The presented exploratory case study may encourage other educators to try this approach for their courses and teaching contexts.

Limitations and Future Research

This paper presents the pedagogical approach for a sustainable supply chain management course, focusing on the experiential learning method introduced by Kolb (1976, 1984). It showcases examples of teaching interventions, interprets these in the context of Kolb's experiential learning cycle and compares them to pre-post data from the SMI[®]. The analysis of this data is preliminary though. Furthermore, the authors collected a rich data source of reflective essays and focus group feedback. Future data analysis will comprise a detailed mapping of experiential learning interventions to changes in PTSM scores, as well as sentiment analysis of the essays.

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