

## Enhancing TVET teachers' capacity to develop students' generic green skills: a work-based learning model for professional development of teachers

---

### Abstract

Reorienting existing educational programs in technical and vocational education and training (TVET) for the purposes of advancing the attainment of sustainable development goals (SDGs) through skills development significantly depends on the capacity of educators. This capacity can be enhanced through teacher training and professional development programs based on principles of adult learning, as well as through the use of sustainability related resources designed for use in student-centered TVET classrooms. This paper considers how TVET educators respond to the reorientation of the curriculum towards Education for Sustainable Development (ESD) through the inclusion of generic green skills in a green module that was delivered by one TVET institute in Hong Kong. It examines how different types of teachers respond to sustainability related, work-based training conducted through action research. Four teachers' attitudes are examined, based on their expertise in ESD and their motivation to change current practice. Based on the findings, this paper puts forward a work-based learning model for the professional development of TVET teachers that encourages them to learn with researchers and students together. The model can be adjusted to meet the needs of different types of teachers and it has the potential to enhance teachers' capacity to implement green modules that will support students' generic green skills development.

**Keywords:** *Teacher training and professional development, TVET, generic green skills, work-based learning professional development model, sustainability related resources, SDGs, experiential learning, transformative learning*

### 1 Introduction

Building the capacities of educators and trainers to facilitate learning for sustainable development has been proposed as one of the five priority action areas in the Roadmap for implementing Global Action Programme (GAP) on Education for Sustainable Development (ESD) (UNESCO 2014). Research on the role of teachers also showed that **the competencies to implement** high quality education for sustainability are necessary for changes to occur in classroom practice (Pavlova 2009). Thus, issues related to the development of teachers' competencies for ESD inclusion is an important area for research and development studies.

Since the release of the *Guidelines and Recommendations for Reorienting Teacher Education to Address Sustainability* (UNESCO) in 2005 (prepared for United Nations Decade of

Education for Sustainable Development), teacher education institutions around the world have started to include ESD in teacher training and professional development programs. A range of studies that focused on examining these programs has been conducted to identify the initiatives that include ESD in teacher education. Despite of this effort, **a lack of appropriate professional development support** for teachers has been consistently identified among the main barriers for inclusion of more ESD related activities in classroom practices (Hill & Elshof 2007; Pavlova 2009). A recent study by Pavlova & Chen (2018) conducted in a technical and vocational education and training (TVET) institution in Hong Kong, revealed the same findings. The study focused on understanding how teachers and students respond to a generic green module that introduced sustainability issues and concepts into the TVET curriculum. Reorienting existing educational programs in TVET for the purposes of advancing the attainment of SDGs through skills development significantly depends on the capacity of educators. The results revealed the need for appropriate professional development to support change in pedagogy as being the priority for curriculum reorientation. The same was identified by Tilbury (2010) who indicated that to use participatory and active learning approaches to support students' learning for sustainability is a challenge for teachers and it requires professional development because the simple provision of toolkits or resources is insufficient.

This paper discusses existing models of teacher professional development (PD) for ESD, and examines the results of a small-scale study about establishing PD for TVET teachers so they are able to successfully include generic green skills in the curriculum. In particular, the paper presents findings about how teachers learn to implement the ESD resources in their classroom practice. The paper classifies teachers into different types, based on their expertise in ESD and motivation to introduce change, and suggests a work-based learning model for PD that encourages teachers to learn alongside researchers and students. The model has the potential to significantly enhance teachers' capacity to implement green modules that will support students' generic green skills development.

## **2 Current theories and practices of in-service teacher professional development for the purposes of ESD inclusion**

This section examines current theories and practices related to including ESD into teacher training. Three models that have been broadly used in ESD initiatives for teacher education were analyzed with the aim of formulating an intervention plan for the study and to develop a work-based learning model for teacher professional development. In addition, two adult learning theories that related to work-based learning are reviewed to understand how teachers respond to training related to curriculum reorientation and to ascertain the extent to which they can be used for the development of a work-based learning model for PD of TVET teachers.

## 2.1 Three models that informed the development of an in-service teacher professional development model towards ESD inclusion

Ferreira, Ryan and Tilbury (2006) examined a range of teacher training programs to identify **models** for the professional development of teachers and **initiatives developed based on those models** that can bring changes toward sustainability education in teacher education. Although the identified models and initiatives were not specific to TVET teachers, they provide an important theoretical foundation for this study that is specifically focused on the development of training/learning models for PD of TVET teachers. Three models were identified in Ferreira, Ryan and Tilbury (2006) and they are discussed below.

### Model 1: The Collaborative Resource Development and Adaptation Model

The Collaborative Resource Development and Adaptation Model that supports teaching and learning resource development and dissemination has been widely used in PD. The model assumes that change occurs through the provision of curriculum resources, combined with pedagogical guidelines and adequate training in the use of those resources.

The resources developed for PD programs that address a range of issues are usually teaching kits, which can be used in a variety of learning settings, such as whole classes, small groups as well as self-guided study materials for in-service teachers. In addition, relevant PD courses are developed along with the resources to assist teachers to implement the materials within particular setting. An examination of different initiatives that have adopted this particular model reveals that resources adaptation and innovation can provide capacity-building opportunities for teachers and teacher educators. Furthermore, the initiatives that involved practicing educators and teacher educators in the process of resource development and resource adaptation to suit local contexts broadened the influence on curriculum change and teacher education. Two examples are: the in-service project *Sustainability Education in European Primary Schools (SEEPS)* and the *Teaching and Learning at the Environment, Science, Society Interface (TaLESSI) (1997-2001)*.

### Model 2: The Action Research Model

Action research, as a process of PD, can build the capacity of educators through a four-phase cyclical model of critical enquiry, which includes: plan formation, action, outcome observation and reflection. This model assumes that key stakeholders' deep engagement and support is critical in increasing participants' competency and propensity to act for change. From this perspective, the longevity of the intervention could be enhanced.

Initiatives that used the action research model also developed a new curriculum, however they sought to develop a deep level of engagement amongst educators as the key agents of change during the process. For example, in order to bring about systemic change the project, *Learning for a Sustainable Environment: Innovations in Teacher Education (LSE) (1994-1997)* utilized a multi-system partnership approach that was based on the action research model, in order to build a strong relationship between professional development, curriculum development, networking and practitioner-based research within the political, cultural and

institutional contexts of teacher education. Participants in this project were supported in the process of material development, experimentation with methodologies and innovation, sharing with colleagues, adapting materials for different cultural settings, and finally evaluating, pilot-testing and refining resources.

### **Model 3: The Whole-of-System Model**

The Whole-of-System Model adopts a comprehensive contextual understanding of the nature of change. The model assumes that change towards sustainability will only occur if all levels and contexts within the system are aligned in their efforts. This systematic model is complex, as it needs to consider the multi-layered factors and components within an organization and leverage top-down and bottom-up approaches towards change simultaneously.

The initiatives based on this model seek to address not only the development of new curriculum content and/or pedagogical approaches towards sustainability, but also to make the change occur in a multi-faceted and system-wide level. For example, the *Sustainable Teacher Environmental Education Project (STEEP) (2002-2004)* was a good example of creating systemic transformation, by bringing about broad change across the whole of the pre-service teacher education system.

In summary, the change and influence of PD towards ESD inclusion gets progressively deeper and broader from model 1 to model 3. Model 1 focuses more on resources and pedagogical approaches that could be adopted for curriculum reorientation towards ESD inclusion. This model can start with just one learning module, or a whole training program, by including teaching kits that address a range of ESD issues. The change in model 1 usually occurred within the classroom. Model 2 seeks to engage more key stakeholders, and teachers act as researchers to achieve change. They engage in the process of professional development through the development and adaptation of resources and pedagogical approaches. During this process, educators work with experts, or researchers, to identify problems together and make plans, develop the curriculum, implement the intervention plan and evaluate the impact towards ESD inclusion. Model 3 targets systematic change, which needs to align stakeholders within a whole system to work together. If the curriculum is changed, as a part of systematic change, the multi-layered factors and components such as the learning environment, student assessment and educational system are re-examined and changed jointly. Thus, model 3 will have a synergistic effect on curriculum change.

## **2.2 Adult learning theory that related to work-based learning (WBL)**

To design an effective PD program there is a requirement to understand the ways in which adults learn. Different perspectives on adult learning processes offer principles to be used for developing an approach for PD of TVET teachers. Such theories as andragogy, transformational learning, experiential learning, and others put forward a number of principles that can be considered to be the conditions of adult learning. For our study, work-

based learning is a key theory to consider, as the context for our study is classrooms where TVET teachers work.

Work-based learning (WBL) refers to the formalization of learning at work, which could be described as “**learning for and from work**” (Velzen et al. 2012, 230). It can also be briefly and broadly defined as “*learning that takes place in a workplace whether as part of a course, while on placement, or independently while an employed worker*” (Iredale et al. 2013, 198), whereby opportunities for learning occur in the field, so learners can transform their conceptual knowledge into experimentation or practice. WBL has been used in variety of education and training programs in different disciplines such as nursing, teacher training, vocational training and engineering (World Association for Cooperative Education 2000; Coll, Taylor, & Nathan 2003). In this study, WBL was provided to TVET teachers and focused on how to implement and adjust the ESD teaching and learning resources in their classroom settings. They also gained ESD teaching and learning experiences through close collaboration with a researcher.

**Experience and reflection** have been identified as two essential components in work-based learning (Iredale et al. 2013). Both theory and research demonstrate that learning through experience greatly benefits adult learners at WBL (Sisselman-Borgia & Torino 2017). The combination of theorized thinking with practitioner’s real-world experiences and learning makes **reflection on practice** a powerful tool in WBL (Helyer 2015). In its *Guidelines and Recommendations for Reorienting Teacher Education for ESD*, UNESCO (2005) also identified the necessity of including real-life experience in teacher education to address sustainability. Many studies confirm the importance of experiential learning and reflective learning for teacher education. Pennington (1995) highlights that experiential learning was paramount in bringing about change and development in teachers’ prior beliefs and behavior. Dewey (1933, 1938) stresses that reflective learning is a critical component of teacher education. Below we examine experiential and reflective learning as essential aspects of WBL for teacher professional development.

### 2.2.1 *Experiential learning*

Experiential Learning Theory (ELT) emphasizes the central role experience plays in the learning process. It defines learning as

*“the process whereby knowledge is created through the transformation to experience. Knowledge results from the combination of **grasping and transforming experience**”* (Kolb 1984, 41, cited in Kolb, Boyatzis, & Mainemelis 1999).

In the ELT model, grasping experience is dialectically related to learning stages of **concrete experience (CE)** and **abstract conceptualization (AC)**, while transforming experience is related to **reflective observation (RO)** and **active experimentation (AE)**. Learning, from this perspective, is conceived as a four-stage cycle as shown in Figure 1.

*“Immediate concrete experience is the basis for observation and reflection. These observations are assimilate into a 'theory' from which new implications for action can be deduced. These implications or hypotheses then serve as guides in acting to create new experiences.” (Kolb & Fry 1975, 34).*

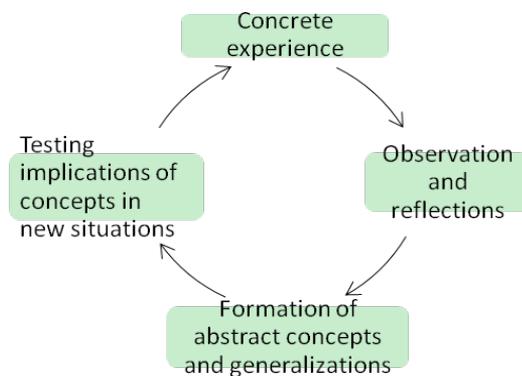


Figure 1: The experiential learning model (Kolb & Fry 1975, 33)

Kolb & Fry (1975) regard learning as an integrated process with each stage feeding into the next and being mutually supportive of each stage. The learner reflects on the experience and generates abstract concepts, which become the conclusions that can be applied to new experiences. In addition, the cyclical nature of the model also means it is possible to enter the cycle at any stage and follow it through the logical sequence.

Moon (2004) later proposed a reproductive cycle that follows Kolb & Fry’s terminology, but reverses “abstract conceptualization” and “reflection”, as shown in Figure 2.

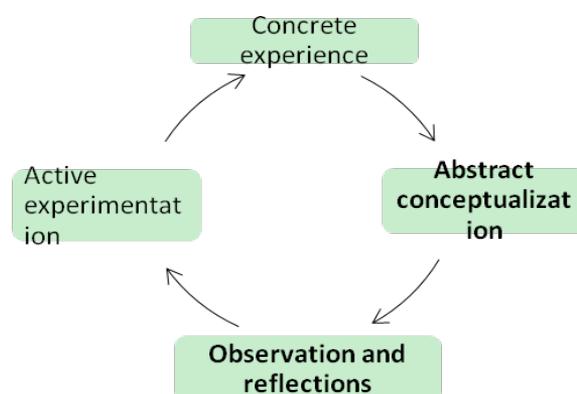


Figure 2: The reproductive experiential learning model (Moon 2004, 126)

Although the learning sequences in the two models differ slightly, the same key processes are involved – experiential learning facilitates the learner to transform concrete experience into active experimentation through reflection and abstract conceptualization in order to achieve change.

### 2.2.2 *Reflective learning*

Moon (2004) suggests that reflective learning simply emphasizes the intention of **learning as a result of reflection**. There are four ways reflection is involved in learning.

First, reflection is involved in the process of meaningful learning when a learner takes a **deep approach** in order to grasp the meaning of new material with reference to previous knowledge. Second, reflection is involved when learning is **represented meaningfully** (e.g. the act of teaching is an example of representation of meaningful knowledge). During this process, the learning material needs to be modified to meet the requirements of the purpose and the format of knowledge representation. As a consequence, a greater understanding of new ideas can be gained if they are represented through the reformulation of current understanding.

The third way reflection is involved in the learning process is by "**upgrading learning**", which means that although there may be nothing new to learn in terms of content, ideas learned in a relatively non-meaningful way are **reconsidered in the light of new experience** in order to make less meaningful learning more meaningful ('deepened') (Moon 1999). Thus, reflection on ideas is based on reconsidered experience. Finally, reflection is involved when learners generate apparently new and meaningful ideas, which are not immediately related to existing knowledge but are based on **what they "know"** already (their prior experience). This process is similar to intuition, and is encapsulated in the phrase, "I saw the light" (Atkinson & Claxton 2002, cited in Moon 2004).

Boud, Keogh, & Walker (1985) indicate that reflection in the context of learning is a generic term that refers to learner's engagement in the exploration of experiences, in order to gain new understandings and appreciations. They proposed a model that illustrates the reflective processes in learning (Figure 3).

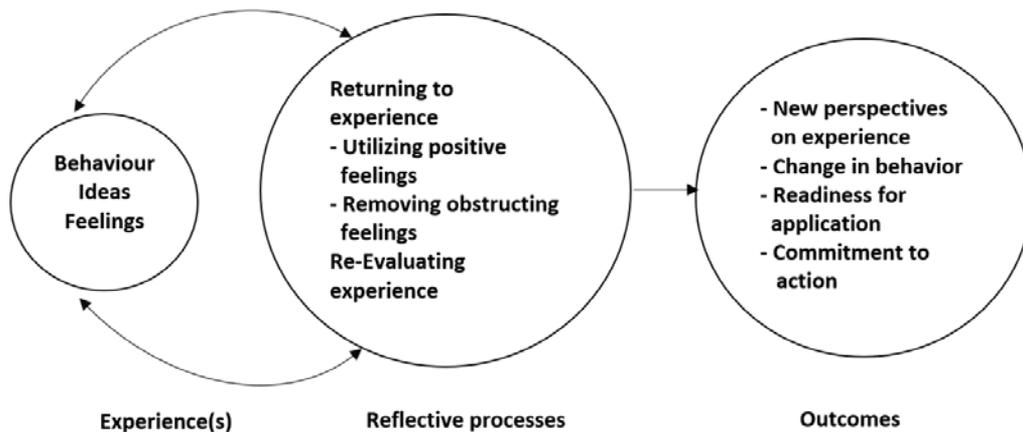


Figure 3: The reflective process in context (Boud, Keogh, & Walker 1985)

This model reveals the relationship between experience(s) and different reflective processes. The totality of experiences includes: the behavior people have performed, the ideas of which people are aware and the feelings they have experienced. Each of these experiences can become the subject of reflection by returning to the experience and re-evaluating it. The outcomes of this type of reflective learning are that learners gain new perspectives on their experiences, they make changes in behavior, and demonstrate readiness and commitment to act (Boud, Keogh, & Walker 1985).

Accordingly, Boud, Keogh, & Walker's (1985) and Moon's (2004) models both suggest that learners' prior experience as well as new experience are the essential foundations for reflective learning. Through the cycle of returning and re-evaluating experience(s), learners become involved in the process of knowledge application and make changes to their behavior, attitudes and values.

In summary, following the examination of three models that have been effectively used for teacher education for ESD implementation in the curriculum and analysis of critical theories and models related to work-based learning that have been selected as the context for PD learning for our research, we developed a theoretical framework for this study that is discussed in the next section.

### 3 Methodology

This study is a small-scale qualitative research project that utilizes **action research** as the overall methodological approach. It is done in accord with Model 2 discussed in the previous section, as this approach allows teachers to be involved in curriculum reform in the

workplace. The intention of this study was to engage and support teachers to implement, and adjust, resources designed by the research team for developing students' generic green skills in TVET. Although training about how to use resources can be classified under model 1 (see previous section) teachers had the opportunity to engage and modify resources and pedagogical strategies for their classrooms based on reflections and interactions with the researchers.

This section discusses the approach for action research used in this study and the intervention plan developed for the research, with reference to the PD models reviewed above.

### 3.1 Action Research – Definition and Cycle Model

Cunningham (1993) defined “action research” as

*“a term for describing a spectrum of activities that focus on research, planning, theorizing, learning, and development.”* (4).

Action research has been used for both pragmatic studies that focus on **collaborative problem solving and joint learning**, as well as experimental studies that focus on theory building and experimentation (Cunningham 1993).

Thus action research, which includes a spectrum of activities carried out in different processes for different objectives such as research, planning, theorizing, learning, and development, can be applied to different settings. Action research in this study is viewed as a **series of actions**, such as developing learning materials, conducting classroom observations, improving classroom practice and enhancing teachers' capacity to implement a generic green module to support the achievement of SDGs.

Action research is regarded as one kind of **action inquiry** (Figure 4), which follows

*“a cycle to improve practice by systematically oscillating between taking action in the field of practice, and inquiry of them”* (Tripp 2005, 2).

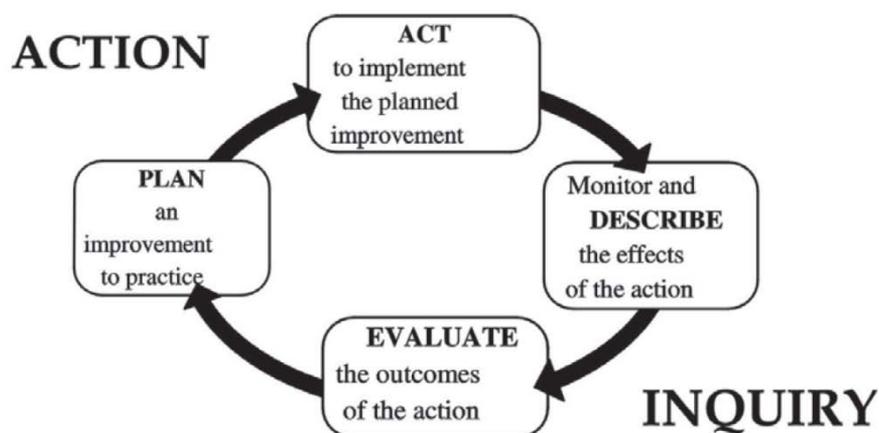


Figure 4: The four-phase representation of the basic action inquiry cycle (Tripp 2005, 2)

The cycle begins with planning an improvement, followed by implementing the planned improvement, and then goes on to monitoring and describing the effects of the action. The end of a cycle is an evaluation of outcomes, which also forms the beginning of the next cycle. It should be noted that different actions will be required in each phase and, in addition, actions can start at different phases. This depends on the specific purposes the basic action inquiry cycle is used for.

The **problem-focused improvement process** is a central feature in the design of most action research projects (Rosaline 2008, 6). The spiral model of the action research cycle (see Figure 5) moves continuously as an iterative process through the stages of:

- 1) Identification of the problem
- 2) Planning of the intervention
- 3) Implementation
- 4) Evaluation of change

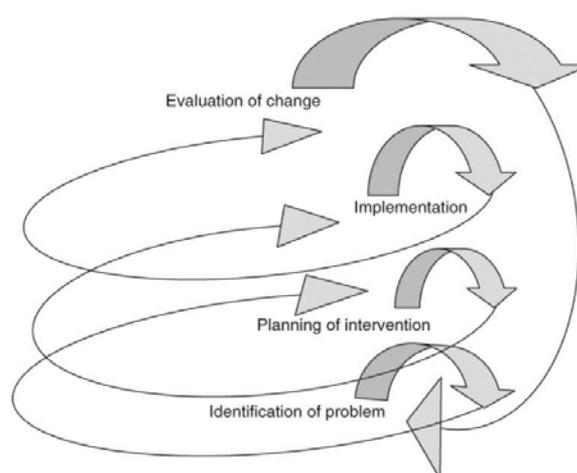


Figure 5: The spiral of action research (Rosaline 2008, 7).

The end of one cycle is the beginning of the next. This study was based on two cycles. Evaluation of the first cycle formed the basis of the beginning of the second cycle, where further actions needed to be planned based on specific problems that emerged in classroom practice, as well as teachers and students' responses and reflections on current and previous actions.

### 3.2 Participants and setting

This study was conducted at a TVET institution in Hong Kong and involved the delivery of the enrichment green module, "green knowledge and practice". Researchers worked with four different teachers who agreed to use teaching and learning resources designed for the development of generic green skills (Pavlova & Chen 2018) into the current module through two classroom sessions. The sessions were three hours each and assessment was one final project. Action research was used to enhance teachers' capacity to address students' generic

green skills development throughout the green module. One session was focused on green technology, the other on the closed-loop economy. The topic for the final project was “Urban innovation for the sustainable development in Hong Kong” which was based on the concept of sustainable innovation.

Four classes of students (a total of 115 students) were involved in this action research. Two of these were part-time students majoring in construction, the other two were full-time students majoring in a variety of subjects, such as hotel management, IT and early childhood education, etc. Four teachers were also involved in this study, and they were both part-time and full-time.

### **3.3 Intervention plan**

The intervention plan developed below illustrates the activities that were carried out through different processes to meet different objectives. The identified processes included: resource introduction, lesson demonstration, reflective conversation, resource adjustment and classroom practice. This intervention plan consisted of six steps and was based on two action research cycles.

#### **Step 1: Introduce resources and discuss with teachers how to use them – before the class**

The researcher introduced the resources and discussed what was included in the teaching kits and what pedagogical strategies were suggested for teaching. This was completed with all teachers teaching the module. The researcher also discussed how to include resources in teaching, based on the current teaching and learning content of the module. Then four teachers who were interested in participating were identified and the researcher had an individual discussion with each of them before the first class. At this stage, the researcher connected the new teaching materials to the teachers’ previous teaching experience and tried to understand the challenges or concerns teachers may have.

#### **Step 2: Demonstrate how to implement resources – during the class**

The researcher demonstrated how to implement the resources, so the teachers could observe the use of different pedagogical approaches and curriculum resources to bring change to both the classroom and teacher-student interaction. This demonstration consisted of two parts. First the researcher gave a half hour lecture to review the learning content with students in an interactive manner, and the second part was different for the teachers who engaged in the study. Some of them continued to observe, some worked with the researcher to facilitate group discussions. For several teachers, their role during the second cycle changed.

#### **Step 3: Conduct reflective conversation with teacher – after the class**

After the demonstration and the end of the class, the researcher conducted a reflective conversation with each teacher individually that focused on what they thought about the new resources and the change to pedagogical approaches as well changes in student’s learning in the classroom. Reflective conversation is a key step that helps the researcher understand the

teacher's perceptions of change and encourages the teacher to think about how to improve current practice in the next cycle.

#### **Step 4: Adjusting the teaching materials and/or teaching strategies with teacher together – before the next class**

The researcher adjusted teaching materials and/or teaching strategies with each teacher based on the reflective conversations, so that the resources and teaching approaches were tailored to fit different learning settings and needs. The researcher provided suggestions based on the teachers' questions and concerns.

#### **Step 5: Teacher tries to use the resources and apply student-centered teaching strategies**

The ultimate goal was to support teachers to design their next lesson, so they could manage overall classroom instruction, based on suggested/adjusted resources. Some teachers were able to achieve this, so the researcher acted as a co-teacher or assistant during the second class. However, in one class the researcher continued with teaching the class as one cycle was not enough for one teacher to feel confident to teach on her own. Therefore, this step remained flexible and teachers exhibited different levels of leadership in terms of teaching.

#### **Step 6: Conduct reflective conversation with teacher – after the second class**

After teachers tried to implement the resources in the classroom, the researcher conducted a reflective conversation with each teacher individually. At this last step of an intervention cycle there was a need to facilitate teachers to reflect on teaching and learning that was based on the use of suggested/adjusted resources, to provide feedback to the teacher about how to improve further and put in place an action plan for the next cycle.

During the implementation of this model, the main differences were at step 5. For the first cycle, the researcher performed a lesson demonstration using the same material kit in each of the four classes. After that, the researcher conducted reflective conversation with teachers individually. For the second cycle (step 5), one teacher was happy to try out a whole materials kit by himself, two teachers engaged to some extent in the overall instructions and tried out part of the materials during small group discussions, and one teacher preferred to act as an observer while the researcher taught. Thus, during the interventions, the teachers were engaged in co-teaching differently.

## **4 Findings and Suggestions**

This section reports on how different teachers respond to curriculum reorientation towards ESD inclusion and classifies teachers into types. It also introduces a work-based learning model that could be used for PD to enhance teachers' capacity to develop students' generic green skills in TVET. It encourages teachers to learn in the classroom by co-teaching with the researcher and using different pedagogy and teaching/learning resources.

#### 4.1 How different types of teachers respond to the curriculum reorientation towards ESD inclusion

The results of this study identified that different teachers engaged differently in the process of curriculum reorientation towards ESD inclusion. Based on the researcher's observations and reflective conversations during the study, as well as a selection of a particular type of co-teaching, it was noted that teachers' backgrounds in terms of exposure to sustainability issues and readiness for change were among the main factors that influence teachers' behavior. Differences in teachers' attitudes within this study also indicated that they might need to have different forms of PD. Thus, a PD program should be flexible and designed to equip different teachers with ESD competencies.

##### 4.1.1 A two-dimension framework for the identification of different types of teacher

In searching for an approach for classifying teachers into different types, the researchers referred to the study by Pitt & Lubben (2009) who classified teachers into three types, based on teachers' different **motives** for engaging in the Sustainable Design Award (SDA) project during their teaching. (SDA asked teachers to provide opportunities for students of Design and Technology [D&T] classes to formulate and realize a D&T project that addresses sustainability issues). These three types include:

- 1) **SD devotees.** The teachers who are **passionate about, and committed to**, sustainable development (SD) before getting involved in the SDA project. Therefore, the SDA project became a vehicle for them to integrate SD into their Design and Technology teaching.
- 2) **SD seekers.** The teachers who are **looking for** more connected thinking for D&T teaching. The SDA project approach could work as a cohesive framework and represent new mindset with which to underpin their overall approach to teaching D&T.
- 3) **SD surfers.** The teachers who consider the SDA project as "just-another-award" scheme. They don't encourage students to engage in the SD Award, and also don't adopt an SD curriculum but they do consider entering students for alternative schemes, such as the Design and Innovation Award for Young Engineers.

Based on this approach, that is focused on teachers' motivation for introducing sustainability into their teaching of D&T (Pitt & Lubben 2009), the researchers proposed a **two-dimensional framework** (see Figure 6) to identify different types of teacher as well as their needs in terms of work-based professional development for ESD inclusion. The first dimension is related to teachers' working experience relevant to sustainability (this is a very important influential factor, as most of the teachers teaching in green modules in TVET are not specialized in sustainability subjects). The second dimension is related to teachers' motivation to achieve pedagogical change for ESD inclusion.

According to this proposed classification framework, the four teachers involved in this study were located differently in Figure 6. Below is an introduction to each teacher that highlights

their work experience in relation to sustainability and their motivation to making pedagogical change for ESD inclusion.

**Teacher A** has rich work experiences related to sustainability in the construction sector. He conducts research on developing building materials and green technologies that are environmentally friendly, and has more than 10 patents in this area (e.g. related to green brick and solar panels). Now he is a part-time teacher of two generic green modules for part-time construction students. Teacher A said he is used to facilitating project-based and problem-based learning. He strongly believed that in a more interactive learning setting students could learn more and reflect more on what they learned.

**Teacher B** is a full-time teacher working in the engineering department. He does not have much work experience related to sustainability, but is familiar with some important sustainability issues within his area, such as renewable energy. He believes that inclusion of more interactive classroom activities can increase students' classroom engagement. He also considered that lecture-based classroom practice should be changed, but he also worried that the knowledge-based assessment couldn't encourage teachers and students to make the change.

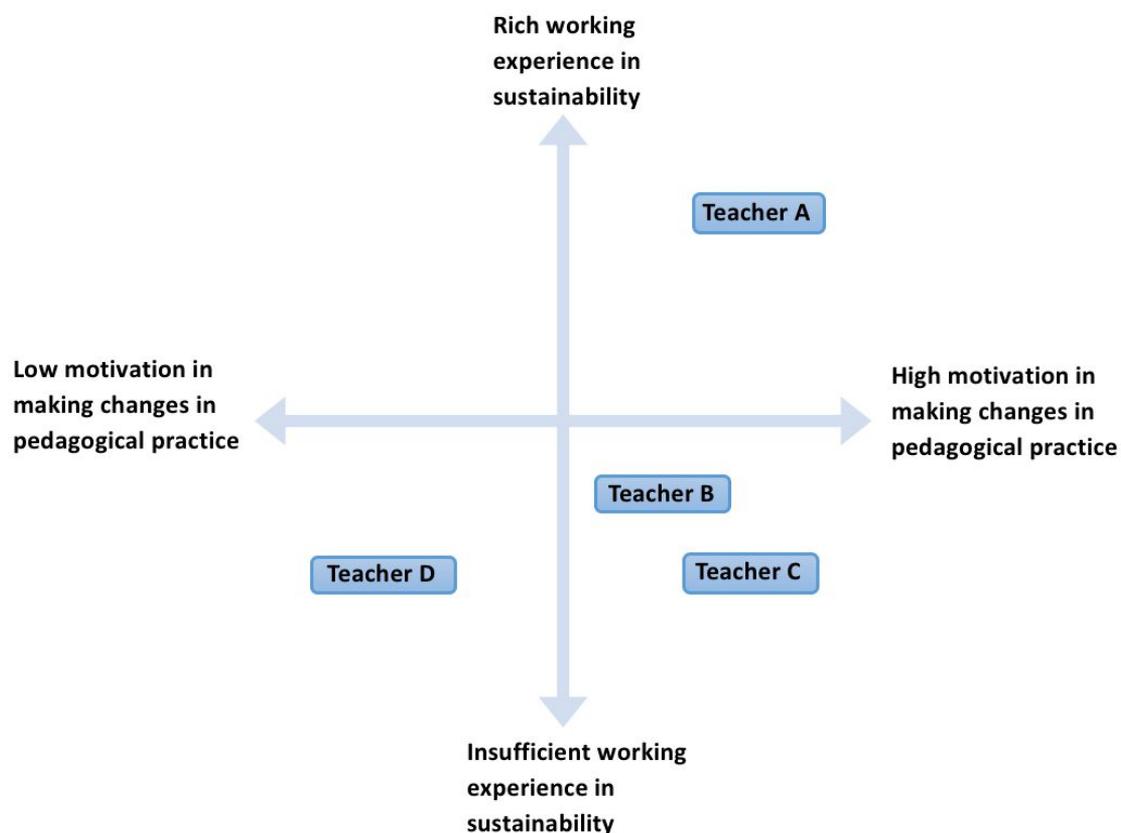


Figure 6: A two-dimensional framework for the identification of different types of teacher (Source: authors)

**Teacher C** is a full-time teacher of a mathematics-related subject in this TVET institute, and he works as a part-time teacher for this generic green module. He majored in chemistry at university, but does not have work experience related to sustainability. He said he is not very familiar with sustainability issues and also the teaching content, so generally he needed to take time to learn from the teaching and learning resources first and then think about how to implement in a classroom. However, he thought the materials were quite interesting and could expand his knowledge, so he was willing to spend time learning them. He also considered problem and project-based learning to be an effective pedagogical approach to implement ESD in TVET, even though he did not have experience teaching in multi-disciplinary subjects.

**Teacher D** is a part-time teacher who does not have any work experience related to sustainability. She did not care much about how students learn or about the importance of including ESD in TVET sector. Before the intervention, she just followed the teaching content provided by the module coordinator in the form of PowerPoint presentations, and did not attempt to make changes/improvements. She does not have sufficient motivation to engage in the introduction of new resources.

#### 4.1.2 *The responses of different types of teachers in this study*

1) The teacher who has more sustainability related experience tends to be more willing to engage in the curriculum reorientation for ESD inclusion and also to embrace the ESD. It is easier for him to understand and implement the resources in the classroom. Specifically, he (teacher A in this study) has more prior experience and these become the sources for reflection and can also reflect on his WBL in different ways (the four different ways were summarized in section 2.2.2 above). These factors would contribute to achieving outcomes in terms of action and commitment in the Boud, Keogh, & Walker (1985) model. Teacher A reported that

*“For me, it is very easy to handle the new resources. I don’t need to spend lots of time to understand it. I am familiar with the content, so it will be easy for me to think about how to organize the learning activities and also facilitate the discussion.”*

2) When teachers, as learners, identify a need to “learn” more about sustainability, they tend to have higher motivation to get involved in professional development towards ESD inclusion (e.g. teacher C in this study). The process that makes teachers aware of the “need” relates to the learning stage in Kolb's model of gaining concrete experience, and observing and reflecting. With respect to the intervention in this study, it started from an introduction to the resources, then progressed to a lesson demonstration and ended with reflective conversation. Teacher C, is the teacher who has less experience but higher motivation in this study, reported that

*“I did spend time to learn the new resource before I implement. And I feel like that if I want to be a professional teacher teaching in this module, I have to expand my understanding of sustainability. During the lesson demonstration [by the researcher], I facilitate the discussion*

*and also learn with students together, thus not only focus on the pedagogy about how to implement but also on the learning content.”*

3) The teacher who has more meaningful experience with respect to the changes tends to understand the new resources better and generates more ideas about how to implement them. Teacher B had some, but not rich, work experience related to sustainability and was also willing to make a change. After the first lesson demonstration by the researcher, he started to design and organize subsequent tutorials based on the resources by himself. He reported that

*“Compare to the prior lessons, using the new resource encouraged more students to engage in class activities. I can feel that most of the students more enjoyed the discussion and also came out with interesting ideas as the solutions for sustainability issues. Through observation and also through try out new resources by myself, I got more ideas about how to implement and change the pedagogy accordingly.”*

4) The teacher who has the least work experience related to sustainability and a low motivation for change tended to be less willing to play a role in co-teaching or even act as an assistant. For example, teacher D in this study remained an observer though she recognized the change among students. She reported that

*“When I sit in the classroom and observe the lesson demonstration, I can see student become a more active learner and also the issues and case studies that related to local context are really helpful to students’ understanding.”*

In summary, the data collected by this study enables us to argue that teachers’ work experience related to sustainability, and their motivation to make changes in pedagogical practice towards ESD influence their responses to the curriculum reorientation as well as the teacher training provided by the researchers. Considering these observed differences, the work-based learning model suggested by this study for teachers’ professional development towards ESD inclusion in the curriculum should be flexible enough to facilitate the engagement of different teachers. This model is discussed in more detail in the next section.

#### **4.2 Work-based learning model for in-service TVET teachers’ PD towards ESD inclusion**

As stated early in this paper, different types of teachers respond differently to reorienting the curriculum to include ESD. However through observation and reflection on how teachers learn about ESD and learn to include ESD into their teaching, while working with researcher to implement new generic green skills resources (refer to section 3.3 intervention plan), three key learning processes were identified, including: learning from demonstration, learning from reflection and learning from practice. In this study, although ESD resources were used as a starting point for PD, the suggested PD model that can enhance teachers’ capacity to include ESD into the current curriculum and pedagogical practice is also based on action research (a critical enquiry). This entails actively engaging teachers in the ways these resources can be

adapted to their classroom. Thus, in a sense, the suggested PD model is a combination of model 1 and model 2 presented in section 2.1.

The work-based learning model (see Figure 7) has been developed based on the learning processes identified through this research combined with some elements of the theories of experiential learning and reflective learning. The model illustrates how teachers' perception and behavior can be changed through three key learning processes, within a two-way cycle. Between the learning processes of demonstration and reflection, teachers are expected to **gain concrete experiences** about how to use the resources and observe how students respond to them in the classroom, and also to reflect on the new experiences in relation to their prior experiences. As a result, these learning processes facilitate the change of **teachers' perception** towards including the ESD resources as well as pedagogical practices. Through the learning processes of reflection and practice, which were identified as "**active experimentation**" in Kolb & Fry's (1975) model and which emphasize understanding of implications of new actions and development of new experiences, teachers' **teaching behaviors** have been facilitated to change (including the use of student-centered pedagogy).

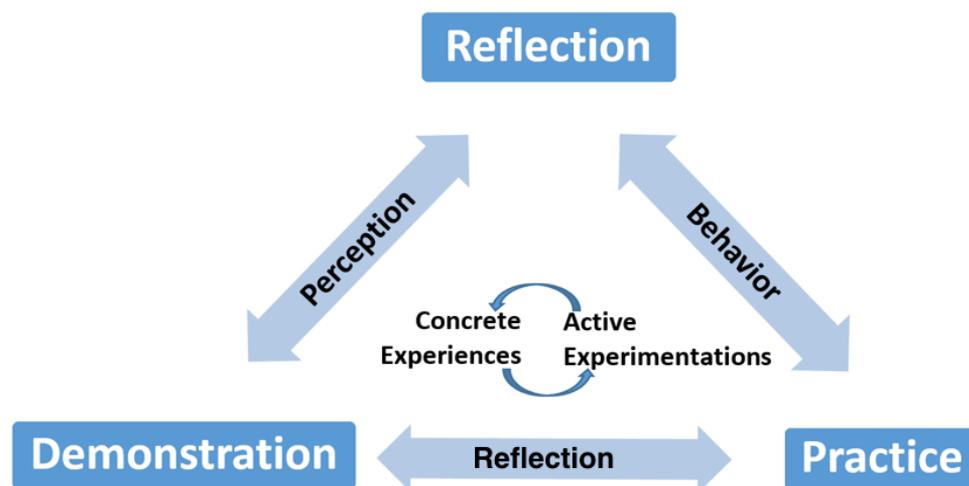


Figure 7: Work-based learning model for TVET teachers' professional development towards ESD inclusion (Source: authors)

Three major components of the work-based learning model, and the ways it facilitates teachers' perceptions and behavior change, are examined in the next section.

#### 4.2.1 *Demonstration is a pivotal starting point for introducing new teaching and learning resources and pedagogical approaches for curriculum reorientation*

As indicated in section 3.2, teachers of this module are not very familiar with the concept of sustainability, relevant issues and pedagogical approaches that are needed for the inclusion of ESD. The traditional way they implement the module was to follow the materials

(PowerPoint with notes) provided to them, and use a lecture-based teaching approach. This would be followed by a test-based assessment. Teachers in this type of situation did not think about making changes, as they didn't have a content knowledge about ESD or the pedagogical skills to organize more interactive teaching and learning activities to engage students. These factors cause difficulties for the introduction of the developed ESD resources. Therefore, the lesson demonstration by the researcher provided an opportunity for teachers to observe new classroom practice.

Putnam & Johns (1987) reviewed the studies that examined different types of demonstrations used in teacher training programs and found that the programs that include demonstration are more effective than those that do not. They summarized the functions of demonstrations as (1) to illustrate teacher instructional behaviors or thinking and decision making processes related to planning and reflection; (2) a stage in the development of desired teaching behavior; (3) an opportunity to assess the cognitive processing skills of students; (4) a means of illustrating the integration of theoretical, research and practical knowledge; (5) a way of critically questioning the rationale for the use of and/or the effects of ideas demonstrated; (6) to develop professors' credibility as they teach and manage students in a class; and (7) a means for professors to explore ideas and remain current about students (577). Although the literature also revealed problems in using demonstrations, such as the unintended messages or misinterpretations that can cause problems in transfer, the demonstrations used in this study brought out positive results and achieved most of the functions summarized in Putnam & Johns (1987) above.

For this research, the findings from classroom observations and reflective conversations revealed that the lesson demonstrations by the researcher provided a direct opportunity for teachers to observe how students respond to the use of new resources, which, to some extent, reduced teachers' nervousness about change. In particular, when teachers saw students' positive reactions and their active engagement in classroom activities, the teachers' perceptions that the new resources can effectively enrich their teaching and students' learning have been developed. Since the teachers witnessed the changes themselves, they became more willing to find out more about the ESD resources and try to include them in their classroom practices. For instance, teacher D in this study was observed to be passively engaged in the intervention. She didn't seem to care about what students had learned or how they learned, but after she witnessed the positive change in students' during the demonstration lesson, she stated, "I can see students are interested in today's learning materials and they engaged much more in the learning activities." In addition, demonstrating how to implement the resources in authentic classroom practices is an effective way of clarifying the underlying principles of student-centered learning embedded in the resources and to introduce relevant pedagogical approaches.

Thus, it can be argued that the researcher's demonstration is a very pivotal step at the beginning of a PD program, as it can present teachers with evidence about how the change could turn out, the challenges teachers may face and also how to include/adjust the ESD

resources into current modules, based on students' learning experiences such as their learning backgrounds and learning habits.

#### *4.2.2 The cycle of demonstration, reflection and practice can facilitate the change from perception to behavior*

Teachers' learning can occur and start with any of identified processes (Figure 7). However, findings from interviews and reflective conversations with teachers revealed that to start with demonstration and then reflect on what has been observed through reflective conversations before going to practice is an effective approach towards initiating changes from perception to behavior. The rationale underlying this approach is related to the relationship between perception and behavior: perception change is a fundamental prerequisite for facilitating behavior change in teaching practice (e.g. pedagogical approaches and lesson design), and behavior change can, in turn, reinforce perception change. There are two basic principles underlying the use of this model.

First, in the cycle between demonstration and reflection, demonstration plays a vital role in creating a **valuable tension** between the outcomes of current practices and the potential outcomes of theoretical or research-based ideas, which helps teachers to become aware of problems (e.g. a lack of interaction between teachers and students) that exist in current practices and the challenges they face. With respect to reflection, it is important to focus the reflection on how the new resources help to improve, or even solve, the identified problems as well as how to implement the new resources in classroom practices.

Second, with reference to the experiential and reflective learning reviewed in section 2.2, reflection creates a link that connects existing knowledge to new experiences that lead to future actions. This process facilitates the transformation between concrete experience and active experimentation (the application of new experience). Concrete experiences gained through demonstration could be transformed into new experiences through **pre-reflection** (reflecting before practice), while practical experience generated from active experimentations could become concrete experiences through **post-reflection** (reflecting after practice) as well. Thus, learning through reflection is an essential process in connecting demonstration and practice, and it leads to the potential for change in perception and behavior towards ESD inclusion.

#### *4.2.3 How to adjust this model to different types of teachers*

The suggested PD model is flexible enough to meet the learning requirements of different types of teachers. The findings demonstrate that the teachers who either have rich work experience related to sustainability or high motivation to make change are more likely to enter the cycle between reflection and practice, and learn better through practice. On the other hand, the teachers who either have insufficient work experience related to sustainability or who have lower motivation to make change are more comfortable to remain in the cycle between demonstration and reflection. They require more concrete experiences that are generated from demonstration as reflective sources to understand the ideas, and also the

resources, and the relevant change to pedagogical approaches. Therefore, for teacher A, who has rich work experience relevant to sustainability and who got used to facilitate project-based learning, the perception towards ESD inclusion was very positive. He needed more support during the process of "learning from practice", such as adjusting the developed ESD resources for his class to maximize the effectiveness of those adapted resources for developing students' generic green skills. Teacher B, who had a bit more experience relevant to sustainability but less motivation to utilize student-center pedagogical approach than teacher C, needed more support for pedagogical understanding and assistance in facilitating the small group work. The demonstration needed to clearly show him how to organize the learning activities so they could provide more interactive learning opportunities for students. Furthermore, although teacher C had few experiences relevant to sustainability, he had a higher motivation to make changes towards including ESD, which made him become an active learner while trying out the resources. He needed more support during the process of "learning through reflection", so the researcher needed to provide feedback to increase his understanding about the resources and improve his practice related to ESD pedagogical strategies. For teacher D, who neither had experience relevant to sustainability nor higher motivation in making changes, she required more support to understand the principles underlying the resources to facilitate perception change. Thus, learning through "demonstration" was important for her. The demonstration helped her not only gain content knowledge, but also to understand how students learn and why ESD pedagogical strategies (e.g. learning from real-world problem solving, stimulus activities and debates) are effective in developing students' generic green skills.

In summary, this proposed work-based learning model revealed the significance of demonstration as a key learning process for transforming teachers' perceptions towards embracing change from the beginning. It also illustrated how the three identified learning processes work together to bring about the potential for change of perception and behavior that can facilitate the inclusion of ESD. Finally, the model revealed the implication of work-based learning on developing in-service teacher training and professional development program.

## **5 Conclusion**

This paper examined selected adult learning theories and models of teacher professional development for ESD, and reported the results of a small-scale study related to establishing PD for TVET teachers for the purposes of introducing generic green skills into the curriculum. Particularly, it presented the findings on how different types of teachers learned to use the developed ESD resources in classroom practice and classified teachers into different types, based on their responses to workplace (classroom) learning for implementing the resources. It also put forward a work-based learning PD model for TVET teachers based on the learning processes identified through action research. This model demonstrates how teachers' perception and behavior change through the WBL learning cycles.

This study is significant as it highlighted the support required for different types of TVET teachers for ESD inclusion in their teaching for the purposes of developing students' generic green skills. We suggest a WBL model that can be used for PD of teachers to respond to their particular needs. The WBL model presented in this paper has the potential to contribute to both the theories and practices of TVET teacher PD for ESD. As a result of this study, TVET teachers' capacity to implement green modules for students' generic green skills development were greatly improved.

## Reference

- Boud, D., Keogh, R., & Walker, D. (1985). *Reflection, turning experience into learning*. London: New York: Kogan Page; Nichols Pub.
- Coll, R., Taylor, N., & Nathan, S. (2003). Using work-based learning to develop education for sustainability: A proposal. In: *Journal of Vocational Education & Training*, 55, 2, 169-182.
- Cunningham, J. B. (1993). *Action Research and Organizational Development*. Westport: Praeger.
- Dewey, J. (1933). *How we think: A restatement of the relation of reflective thinking to the educative process* (Great books in philosophy). Lexington: D.C. Heath and Company.
- Dewey, J. (1938). *Experience and Education*. New York: Macmillan Company.
- Ferreira, J., Ryan, L., & Tilbury, D. (2006). *Whole-School Approaches to Sustainability: A review of models for professional development in pre-service teacher education*. Canberra: Australian Government Department of the Environment and Heritage and the Australian Research Institute in Education for Sustainability (ARIES).
- Heyler, R. (2015). Learning through reflection: The critical role of reflection in work-based learning (WBL). In: *Journal of Work-Applied Management*, 7, 1, 15-27.
- Hill, A. M. & Elshof, L. (2007). Sustainable practices as an aspect of technological literacy: Research findings from secondary school teachers' and their classrooms. Presented at the PATT-18 Pupils Attitudes Towards Technology International Conference on Design and Technology education research. Glasgow.
- Iredale, A., et al. (2013). Confidence, risk, and the journey into praxis: Work-based learning and teacher development. In: *Journal of Education for Teaching*, 39, 2, 197-208.
- Kolb, D. A. & Fry, R. (1975). Toward an applied theory of experiential learning. In C. Cooper (Ed.): *Studies of group process*. New York: Wiley, 33-57.
- Kolb, D. A., Boyatzis, R. E., & Mainemelis, C. (1999). *Experiential learning theory: Previous research and new directions*. Taylor and Francis.
- Moon, J. (1999). *Reflection in Learning and Professional Development*. London: Kogan Page.

Moon, J. (2004). *A handbook of reflective and experiential learning: Theory and practice*. London: New York: Routledge Falmer.

Pavlova, M. & Chen, C.-S. (2019). Facilitating the development of students' generic green skills in TVET: an ESD pedagogical model In: TVET@Asia, issue 19, 1-20. Online: [http://www.tvet-online.asia/issue9/author\\_second\\_tvet9.pdf](http://www.tvet-online.asia/issue9/author_second_tvet9.pdf) (retrieved 30.06.2019)

Pavlova, M. (2009). *Technology and vocational education for sustainable development empowering individuals for the future* (UNESCO-UNEVOC book series; v. 10). Dordrecht: Springer Netherlands.

Pennington, M. (1995). Teacher Change Cycle. In: *TESOL Quarterly*, 29, 4, 705-731.

Pitt, J., & Lubben, F. (2009). The social agenda of education for sustainable development within design & technology: the case of the Sustainable Design Award. In: *International Journal of Technology and Design Education*, 19, 167-186.

Putnam, J. & Johns, B. (1987). The potential of demonstration teaching as a component for teacher preparation and staff development programs. In: *International Journal of Educational Research*, 11, 5, 577-588.

Rosaline, B. (2008). *Introducing Qualitative Research*. London: SAGE Publications.

Sisselman-Borgia, A. & Torino, G. (2017). Innovations in Experiential Learning for Adult Learners. In: *Journal of Applied Learning in Higher Education*, 7, 3-13.

Tilbury, D. (2010). *Assessing ESD Experiences during the DESD: An expert review on processes of learning for ESD*. Paris: UNESCO.

Tripp, D. (2005). Pesquisa-ação: Uma introdução metodológica action research: A methodological introduction. In: *Educação e Pesquisa*, 31, 3, 443-466.

UNESCO (2005). *Guidelines and Recommendations for Reorienting Teacher Education to Address Sustainability*. Online: [http://www.docs.hss.ed.ac.uk/education/outdoored/unesco\\_teacher\\_ed\\_sustainability.pdf](http://www.docs.hss.ed.ac.uk/education/outdoored/unesco_teacher_ed_sustainability.pdf) (retrieved 19.11.2019).

UNESCO (2014). *UNESCO roadmap for implementing the Global Action Programme on Education for Sustainable Development*. Online: <https://unesdoc.unesco.org/ark:/48223/pf0000230514> (retrieved 19.11.2019).

Van Velzen, C., et al. (2012). Guided work-based learning: Sharing practical teaching knowledge with student teachers. In: *Teaching and Teacher Education*, 28, 229-239.

World association for cooperative education. 2000. *Membership Directory*. Boston: WACE.

CITATION:

Pavlova, M. & Chen, C. S. (2020). Enhancing TVET teachers' capacity to develop students' generic green skills: a work-based learning model for professional development of teachers. In: TVET@Asia, issue 14, 1-23. Online: <http://www.tvet-online.asia/issue/issue-14/pavlova-etal> (retrieved 30.12.2019).

## Author(s) Profile

---



**Assoc. Prof. Dr. Margarita Pavlova**

The Education University of Hong Kong

E-mail: [mpavlova@eduhk.hk](mailto:mpavlova@eduhk.hk)



**Christy Shimin Chen**

The Education University of Hong Kong

E-mail: [s1119848@s.eduhk.hk](mailto:s1119848@s.eduhk.hk)

---

This document is published under a Creative Commons Attribution-NonCommercial-NoDerivs3.0 License

