COMPARING SDL IN SINGAPORE AND VIETNAM: APPROACHES AND STUDENT PERCEPTIONS

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ABSTRACT

Self-directed learning (SDL) is becoming a critical and important skill in the labor markets of today's VUCA (volatile, uncertain, complex, ambiguous) world. With significant advances in technology, we are now faced with the challenges of making sense with big data and discerning fake news from genuine ones. SDL is, therefore, a necessary skill in the world we are preparing our students for. However, the classroom culture we have created and inherited is not designed around self-direction, which tends more towards the dissemination of information characterised by large lecture classes, students practicing standard tutorial questions, and for most of the time assessed through time-sensitive examination formats in which students regurgitate information absorbed to demonstrate comprehension. There are, however, many challenges in integrating SDL into an already-packed curriculum. This paper compares the approaches between two institutions in two countries – namely Singapore Polytechnic in Singapore and Duy Tan University in Vietnam – on their respective efforts to impart SDL skills among students. The aim is to learn from each other's practices that both can advance and improve students' learning on these important skills. We are interested in how each institution handles the teaching of SDL skills, faculty preparation, issues and challenges faced, the method used (whether using the CDIO Framework or others; choice of pedagogy, assessment), the measurement used to ascertain the effectiveness of any interventions used, as well as the students' own self-efficacy and perception of SDL in helping them learn better; and lastly plans for moving ahead. This paper firstly provides a brief summary of the vast literature available on these aspects and then shares our findings in the abovementioned areas. It concludes with a discussion on possible ways the 2 institutions can collaborate to further improve each's SDL implementation.

KEYWORDS

Self-Directed Learning, Curriculum design, Standards 3, 7, 8, 11

INTRODUCTION

The world that we know of today in the context of technology adaption, business disruption, and pervasiveness in human-computer interaction is no longer similar to the one a century ago due to the rapid growth of the Internet and technological advancement in computing processing power and speed. With information being processed and exchanged across the globe at a stunning rate (from 100 GB of Internet traffic per day in 1992 to a forecast 157,000GB per second in 2022 (Cisco, 2019), one will inevitably be faced with disruptions in their workplace or a broad context, their job market area, due to the volatility and uncertainty of the environment brought forward by technology disruptions and fast information dissemination. In the current VUCA (volatile, uncertain, complex, ambiguous) world, one needs to have the right growth mindset and skills to be able to navigate the world of big data and the erosion of data integrity due to false or altered information around them. Self-directed learning thus becomes a critical and essential skill set for students to be able to adapt to the ever-changing environment continuously. Having the correct mindset will enable them to see changes as part and parcel of their daily life and be able to take on the role of positive change agents allowing them to effect positive change to the environment and people around them in moments of disruptions.

To draw the link between the industry and one's educational journey, currently, there exists an urgent need to address how we could best instill self-directed learning (SDL) in each student, enabling them to take ownership of their learning similar to the real working world. On an institutional level, we need to continually engage, share our best practices, and collaborate to tackle the challenges in the implementation of SDL, which is inherently different from the classroom culture we have inherited and find the best way ahead for our students.

The updated CDIO syllabus 2.0 captures the essential broad-based knowledge, skills, and attributes in students necessary to prepare them to be successful, young professional engineers for the future. The key areas of SDL in addressing one weakness through self-education, metacognition aspect of thinking, and knowledge integration for lifelong learning are widely summarised and highlighted in part 2.4.5 and 2.4.6 of the CDIO syllabus.

BRIEF LITERATURE REVIEW

In the pioneering work, SDL studies were conducted to gain insight into the deliberated learning effort of adults, their challenges, and the learning process, including intentional and self-planned learning (Tough, 1971). Knowles most notably defines SDL as "a process in which individuals take the initiative without the help of others in diagnosing their learning needs, formulating goals, identifying human and material resources, and evaluating learning outcomes" (Knowles, 1975). Several researches spawned thereafter, which focuses on the model for SDL implementation. Grow (1991, 1994) proposed the SSDL, which consist of 4-stage to match the learner's learning stage according to teaching style. Gibbons (2002) similarly proposed a 4-stage strategy in the context of how an educator will present and developed their course. Once the stage is determined, the curriculum will be designed based on the 3 themes of learning activity, skill to gain, and personal quality to be developed by the students. Brockett & Hiemstra (1991) proposed the Personal Responsibility Orientation (PRO) model, which based on the core of learning on individual responsibility. The learning of individuals depends largely on their learning management and assumption of accountability (ownership). Garrison (1997) proposed a theoretical model that integrates self-management, monitoring, and motivation similarly to achieve SDL. Lastly, Boyers (2014) provided a

summarised overview for SDL research over 30 years exploring the relationship of SDL with self-control, motivation, performance, and self-efficacy.

SUMMARY OF APPROACHES TAKEN BY SP AND DTU

There can be more than one way to introduce SDL into a curriculum, depending on a myriad of factors, not limited to faculty competence, program structure, student cohort size and readiness, existing infrastructure, etc. It is not possible to discuss everything in detail within the limit of this paper. The sections below provide a summary of 2 institutions: Singapore Polytechnic (SP) and Duy Tan University (DTU) in Vietnam.

Institutional Approach to Integrating SDL into Curriculum: SP

To prevent a top-down approach for this SP institutional wide initiative, the SP's SDL model shown in Figure 1 was curated through the collective effort of 88 SP staff of various levels (Academics staff and management) coming together in May 2018. The representatives from the different schools and departments worked together. They jointly provided their inputs through co-created sessions, looking at the best approach to develop our students to be self-directed learners who lead to the original creation of the SP's SDL model.

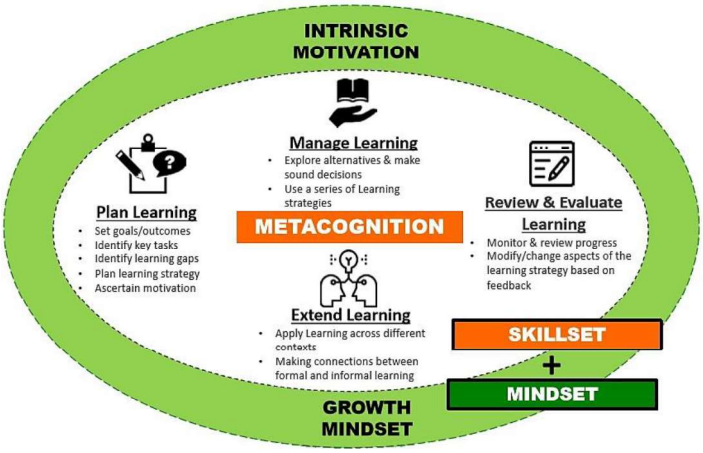

Figure 1. SP Self-Directed Learning Model

From thereon, the Department of Educational Development (EDU) took over the lead in the refinement of the model. It provided advisory for individual schools on the best practices if the schools decided to adopt the model for their curriculum.

Faculty Preparation: SP

EDU does not mandate the adoption of the model but instead uses the model to guide the individual school's diploma in planning. For faculty preparation, a timeframe was set to introduce the SP's SDL model to the respective schools in phases.

Phase 1: Generating Awareness
Phase 2: Experimentation
Phase 3: Measurement and adoption

The various schools were given the freedom to use the SP's SDL model as a fundamental framework and customised it according to their individual needs and requirement. The SP's SDL model denoted in Figure 1 served to achieve one of SP's collective aspirations to help develop our students to be self-directed and knowing how to learn. It focuses on two key abilities in (1) skillset (2) mindset of the individual learner, building the metacognition aspect of learning through the four keys stages of the SP's SDL model. It further instills a growth mindset to enable one to continuously learn, unlearn, and relearn adapting according to environment and needs.

Institutional approach to integrating SDL into the curriculum: DTU

The SDL model used in DTU is shown in Figure 2. It is the result of the process of teaching innovation (applied in the CDIO project) over the past 3 years at the Faculty of Electrical & Electronic Engineering (FEEE). This process consists of 3 basic steps: Learning Ownership, Management of Learning, and Extension of Learning. As an active learning subject, students proactively identify learning goals clearly and specifically. Based on that, students develop their study plan and determine the appropriate level of learning content. From there, they proactively organize learning activities according to the defined plan and content, under the necessary support of the lecturers, to achieve the learning goals.

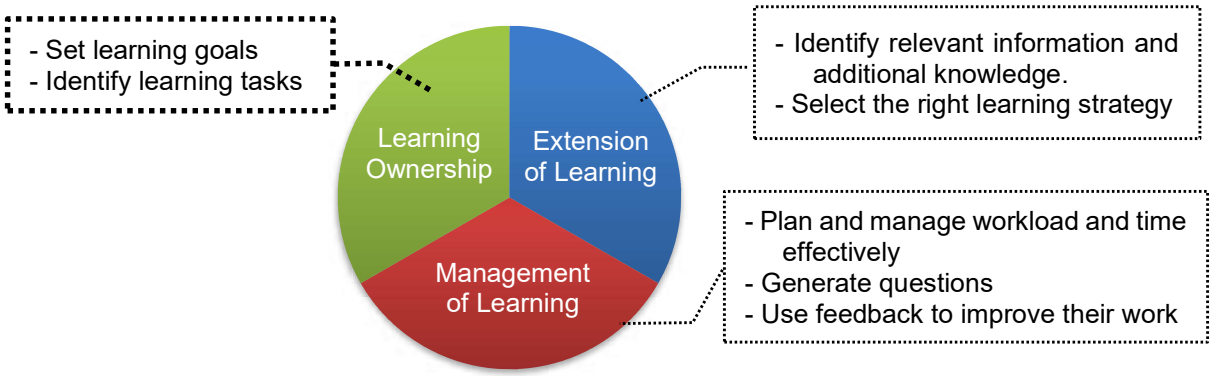

Figure 2. DTU Self-Directed Learning Model

Faculty Preparation: DTU

FEEE regularly organizes seminars to allow each member to participate in CDIO SDL classes to be aware of their mission. These seminars ensure the lecturers understand SDL and the resources needed to understand them (e.g., Learning Resource Center; Internet; Professional journals). Lecturers and students are also provided with instructional materials for using learning software (Learning Management System, Teamwork project software, Dropbox, and Google Drive). Based on the proposed SDL model, each instructor and student must be aware of their role through 5 steps, as shown in Figure 3. Students will be the main implementers. Students must understand: It is not about daily progress; it is about progress daily.

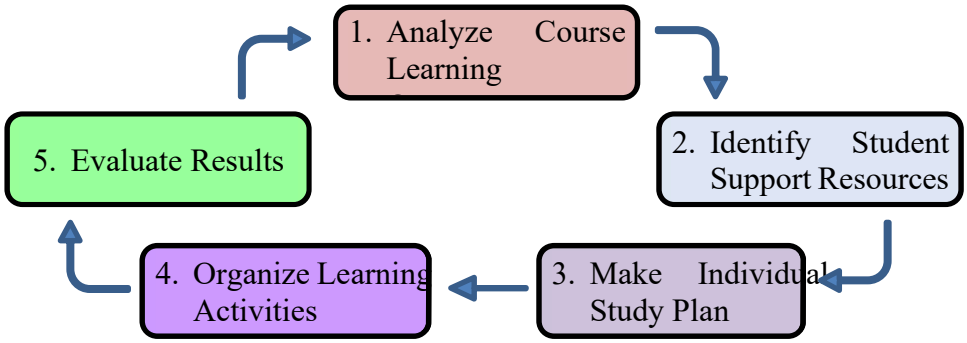

Figure 3. DTU 5-steps Approach to SDL

Issues and Challenges Faced: SP

During the inception of the SDL model, several challenges were faced by both staff and students alike due to the relative newness of the area. For staff, there were genuine concerns on the knowledge and know-how to adapt the SP's SDL model into their current modules and to decide what is the best approach to revamp their teaching approach to bring out the students' self-directed learning behaviours. From the viewpoint of students, the SDL way of learning is very different in comparison to a traditional classroom setting. There is now a need for an individual student to take up more ownership in their learning, setting their own goals, identifying their gaps, and adjusting their learning strategies along the way.

To address the anxiety of academic staff, SP ties together SDL with other supporting initiatives to help them see the connections of what they are venturing towards, is part of the larger picture of institutional-wide effort to redesign SP's education system. Some of the initiatives include:

- Introduction of Poly-wide electives
- Internships
- Education and career guidance
- Flipped Classroom

Issues and Challenges Faced: DTU

Indeed, the SDL implementation in DTU is also challenging for both instructors and students. It takes a lot of effort and time for instructors to compile lectures and video lectures for each Flipped Classroom class. Self-study lectures must be truly concise and, at the same time, ensure the attention of students. The second biggest challenge we encountered was not finding the best solution for tracking students' progress during the project. The unequal level of students' knowledge and awareness makes it difficult to implement a Flipped Classroom. Finally, the specific method we are applying in SDL is the Flipped Classroom, which does not apply to all subjects in the training program, requiring careful selection from the Faculty Advisory Board. On the student side, the biggest challenge is motivation. Self-study is much more challenging than studying under direct instruction. Students also often set learning goals that are too high for their knowledge level. Sometimes, the setting up of necessary tasks to achieve learning goals are also unreasonable because of their inexperience.

Method of Infusing SDL (e.g., CDIO Framework): SP

During the first year of experimentation for SDL, staff from various schools explored and adapted the SP's SDL model for their own curriculum needs. Some examples of the work are summarized in Table 1. EDU then coordinates various sharing sessions for the early adopters to share their learning experiences with other colleagues. Various platforms were utilized – at SP-level, there are events such as Brown Bag sessions, Pedagogy Meetings, Poster Sessions during annual Excellence in Education, and Teaching Conventions. Individual schools also held the annual Teaching & Learning Day, where SDL initiatives are shared.

Method of Infusing SDL (e.g., CDIO Framework): DTU

We started implementing SDL with Flipped Classroom, which is well described in the paper "The effects of Industry 4.0 on teaching and learning CDIO project at Duy Tan University", 2019. When implemented, we encountered several problems and are working hard to solve in the 2019-2020 academic year. We started to apply online software in monitoring the progress of the project implementation of each group student. Teamwork Project software (Teamwork.com, 2019) makes it easy for everyone to see what they are working on, who they are working with, and what comes next - whatever size a team is. Instructors and students discuss to find the most appropriate learning strategy and learning schedule. All are explicitly shown on a Gantt chart. These are the first steps in implementing a Flipped Classroom towards Blended learning. It is a type of multichannel method that incorporates tutor-led activities, images, videos, digital tasks, and face-to-face discussion. The role of the instructor in the development of SDL was also discussed very carefully (Ha et al., 2019). Finally, assessing scores is an essential step in testing students' self-study accumulation. We unified to use the evaluation form divided into many levels 1 - Not proficient, 2 - Less than desired proficiency, 3 - Marginal proficiency, 4 - Good proficiency, 5 - Superior proficiency to evaluate students' CDIO skills. For example, in FEEE CDIO Project 3, we use evaluation forms, including Teamwork Rubric, Technical Report Rubric, Oral Rubric, and Manufacturability of Work Discussion Rubric.

Table 1. Examples of SDL Integration into Curriculum (SP)

Name of School	Description of Work Done	Reference
School of Chemical & Life Sciences	3-year progressive development and transfer of SDL skills in Chemical Engineering using CDIO	Cheah, Wong, & Yang (2019)
School of Architecture & Built Environment	Use flipped learning and integrated SDL experiences for year 1 DCEB[1] students	Soo-Ng (2019)
School of Chemical & Life Sciences	Utilize the data analytics from SmartBook to teach meta-cognition in the teaching of chemistry	Tan (2019)
School of Electrical & Electronic Engineering	Use the internship program, via a journal, report, and assessment as "solution-minded interns."	Anwar (2019)

[1]DIPLOMA IN CIVIL ENGINEERING WITH BUSINESS

School of Electrical & Electronic Engineering	Synergize with IT Curriculum 2017 Framework for an ICT project-based module	Chew, Chia & Teo (2019)
Singapore Maritime Academy	Use competency-based training for his Diploma in Nautical Studies students to learn SDL skills	Savio (2019).
School of Business	Use team-based learning to impart SDL skills among his students in Diploma in Accountancy	Neo (2019)

Measurement of Effectiveness: SP

Measurement techniques are often critical in the evaluation of any pedagogical interventions used in curriculums or modules. In the first year to explore the SP SDL model, the utilisation of measurement tools is still in the infancy stages and required more studies for further refinement. At this point, for most studies (Table 1), the authors focused on understanding students' learning experience with regards to the change in teaching methods to introduce SDL. Helene, Chan & Chong (2019) presented their findings for 4000 SP students using both qualitative and quantitative studies. The objective is to monitor and review the impact of Flipped learning for students and their learning through SDL. The work performed data collection using both pre and post-tests for students, adapting 34 items questionnaire, which comprises learning strategies and Motivation Strategies for Learning Questionnaire (MSLQ) (Pintrich et al. 1991).

In another example, Cheah, Wong & Yang (2019) reported that there is still a significantly large number of Year 1 students in their study who are not receptive to the teaching of SDL. The authors also report that, even though students responded positively to SDL in the survey, the evidence collected (such as a reflective journal) or work done (such as a written report) does not appear to support their claims of being able to apply SDL. It would look while students understand the SDL model and appreciate its importance; still, they are not sure how to put them into practice in different contexts. In addition, different learning abilities among the students will also affect the learning process.

Measurement of Effectiveness: DTU

We are in the third year of applying the Flipped Classroom and the first year of applying group supervision through the Teamwork Project software in CDIO teaching. To evaluate the effectiveness of this method, we have calculated the percentage of students' Superior Proficiency, Proficiency, and Poor Proficiency (Figure 4) in ABET Outcomes 7 (ABET, 2019). The parameters were collected on 4 CDIO CR347 classes in 2018-2019, 2019-2020 academic years. The number of students per class is 20. It was found that the percentage of students who did not achieve SDL skills increased to 20% when applying online study monitoring software. However, with the advantages of using this method, we will continue to use and observe statistics in the following years to make appropriate recommendations.

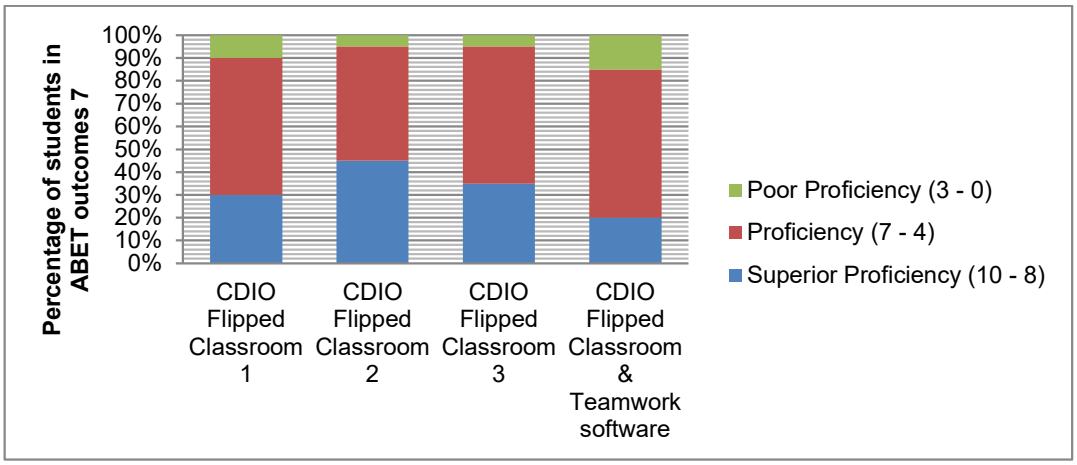

Figure 4. Percentage of students according to ABET Outcomes 7

We also conduct online surveys to determine whether students are satisfied with this learning method. Results showed that 28.7% of the total of 80 students surveyed proved unsuitable for the SDL learning method. The collected data proves that the SDL method we apply must be heavily revised in the future.

Students' Self-efficacy and Perception of SDL: SP

Students are generally receptive to SDL and think that it is useful for their future learning. However, most students find the concept of being entirely self-directed to be fairly new and different from their previous classroom setting. To address this, we need to strengthen further the students' mindset (metacognition) and intrinsic motivation (individual) to encourage them to take ownership of their development, thus growing them to be self-directed in their learning. Below are some of the comments:

"*The current SDL process allows students to reflect and track what they are doing and whether what they are doing is effective. This allows us to know whether we are actually learning or just doing and following instructions from the book blindly*. " - SP Year 2 student

"*Actually no, because I already have my way of learning, so to follow the learning format given, I would have to re-adapt and try to change the way I think*." - SP Year 1 student

"*Yes I believe that the usage of the Self-Directed Learning Model has helped our group to be more systematic in the planning before the experiment*." - SP Year 1 student

Students' Self-efficacy and Perception of SDL: DTU

We consulted 3 students in the same CDIO class to apply the SDL method. These students have very different scores, and their perception of SDL is different.

"SDL is a very interesting learning method. Thanks to it, I eliminated many hours of boring theory lessons. Instead, I took the initiative to set my learning goals and conduct learning whenever, wherever I was to reach that goal. It is challenging to make laws that govern myself, but it will be a good lesson for my future." - CDIO Year 2 student 1

"The CDIO class applies to FC very well, but it is not suitable for me. I need more time to get the theory delivered in class, as well as more exercise. It is very difficult for me to have an overview of an issue when implementing SDL. I always thought I needed an instructor like the other regular classes." - CDIO Year 2 student 2

"SDL is not suitable for many people in the class, including me. This method requires too much research time, while my study and work schedule cannot meet that. I could barely keep up with the classroom lecture and didn't understand the other lecture videos. These self-study videos are long and boring." - CDIO Year 2 student 3

PLANS FOR MOVING AHEAD: SP

Moving forward from the first year to generate awareness of SDL and experimentation of the SP's SDL model, reflections and learning points will be consolidated.

In the next phase (Adoption and Measurement) – more focus and attention is allocated on the efficient implementation of the framework, which will impact the students at diploma and cohort level. Metacognition, which dictates the reflections process of one's learning to achieve a more positive outcome in the future learning cycle, will be more deeply studied and researched.

To quantify the success of the institutional level SDL implementation, there is a need to look into the curation and development of more effective measurement tools using the wide collection of metrics available such as Self-directed learning Readiness Scale (SDL-RS), Motivated Strategies for Learning Questionnaire (MLSQ), graduate surveys, and industry feedback. This allows for self-evaluation and benchmarking to identify the strength, weaknesses, and areas for improvement in the implementations. Lastly, to move towards the collective aspiration of having holistic developments for our graduates and developing them to be self-directed learners, SP is in the process of setting up an innovative SDL ecosystem (see Figure 5), which comprises of curriculum, resources and action research to facilitate the change journey. This will also include tool kits for staff and professional development programs.

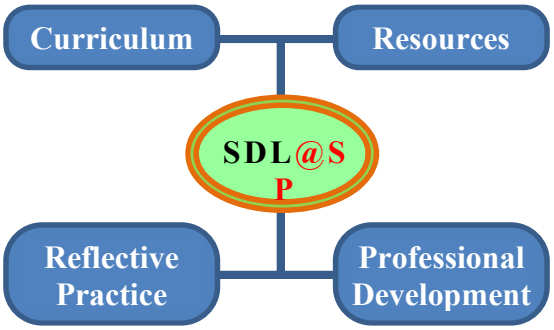

Figure 5. SP's SDL Ecosystem

PLANS FOR MOVING AHEAD: DTU

In the following academic years, we try to perfect the Flipped Classroom method in all CDIO subjects, cover all content: lectures, implementation methods, assessment methods,

supporting software. We also see a lot of problems that still exist in these classes and have proposed a number of remedies:

- Increasing the level of learning interest for students with more vivid video lectures, replacing class assignments with learning games (e.g., Kahoot software).
- For students who have a low level of knowledge and do not keep up with the SDL process (identified through the point of assessment of previous CDIO subjects), the form of "Grouping oriented" will be implemented. The best students will be grouped to support the weaker students; depending on the level of support, there will be corresponding reward points.
- Time management and work efficiency issues should also be considered and handled by the software.

Besides, in addition to the practical skills gained during the teaching process, FEEE instructors will actively participate in the Innovating Educational Methods Conference and CDIO Conferences, Workshop, etc.

DISCUSSIONS ON THE 2 INSTITUTIONS' APPROACH TO SDL

The individual journey of SDL implementations from the two institutions demonstrates the similarities in challenges both faced in curriculum design, staff/students reception towards SDL, having the required knowledge and right mindset to adopt the new domain challenge. SDL, as currently implemented, which uses the 'across-the-board" approach for all students, may pose problems for less academically-abled students. Resource limitations (especially manpower) are a real constraint in supporting the development of SDL competency for all students. Opportunities exist, primarily through the use of educational technology (various Web 2.0 tools) for faculty to offer more customized support for these students.

Granted, the work reported here will not be exhaustive, and there may exist pockets of excellence in various programs. Both institutions will continue to refine their respective approach to SDL. It would be useful for both institutions to continue to capture best practices, as well as gathering evidence of the pros and cons of each approach.

Looking ahead, both institutions show individual strength in educational innovation that could be a potential area that can be further tapped for deeper collaborations. Spawning from this joint paper, work is already underway to strengthen the collaborative efforts between the two institutes. One of the areas of cooperation includes identifying areas of action research where it best benefits the students from the two schools. Another area includes looking into potential future visitation between the two schools and crosses sparring of best practices to encourage the sharing of knowledge and experiences.

CONCLUSIONS

This paper documents the collaborative effort between Singapore Polytechnic (SP) and Duy Tan University (DTU) in Vietnam to share best practices and learn from each other experiences in the context of SDL implementation. The joint work set off with a clear and common objective to learn, share, collaborate, and improve our respective SDL framework and processes to achieve better learning outcomes of the students and experiences for our staff. The paper reported the learning journey undertaken by the two institutions on the integration of SDL to

our respective curriculums, and challenges faced, stakeholders' perception and measurement used to assess the effectiveness of the school's SDL implementation.

Many functional case studies were discussed and shared in this paper, providing a springboard for future works together between the institutes. Taking the collaboration further, potential plans for future discussion into areas including (1) Cross-institutional action research in SDL (2) Visitation that include observation of SDL-related activities and adoption of best practices.

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BIOGRAPHICAL INFORMATION

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