STUDY OF STUDENTS' SELF-DIRECTED LEARNING COMPETENCIES AT SINGAPORE POLYTECHNIC

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ABSTRACT

A key goal of higher education is to prepare graduates to be self-directed lifelong learners imbued with the ability to continuously learn, unlearn and relearn to keep pace with the rapidly transforming industry needs. Singapore Polytechnic has implemented Flipped learning in all its programmes. Studying a flipped learning module requires students to use self-directed learning strategies to review and comprehend the learning materials before class. As a preliminary check on the impact of implementing Flipped Learning on students' learning, a dipstick survey to study students' SDL competences was administered to all students at the end of the academic year in Feb 2023. The objective of the survey was to ascertain students' self-directed competencies in terms of their self-efficacy for learning and their use of different learning strategies. Two components of the Motivated Strategies for Learning Questionnaire, the 'Self-Efficacy for Learning & Performance' (SE) and 'Metacognitive Self-Regulation' (MSR) scales were adopted for the survey. The findings from the survey showed that students perceived themselves as confident of learning concepts taught in their flipped learning modules and believed that they have the ability to do well. They adopted strategies like self-assessment and questioning that helped them monitor how well they understood the material. The paper will present the analysis of the quantitative data findings of the study and the learning and future work that emerged. The study aims to contribute to the ongoing discussion on the importance of SDL in higher education and provide valuable insights for educators and policymakers.

KEYWORDS

Self-directed Learning, Flipped Learning, Assessment, Self-Efficacy, Metacognitive Self-regulation, Standards 8, 11

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INTRODUCTION

Globalisation, new technologies, environmental concerns, economic and political uncertainties are impacting the way we live and work. According to the 2023 World Economic Forum's Future of Jobs Report, the world of work is set to go through major changes in the next 5 years where 23% of jobs will be disrupted, with some eliminated and others created (WEF, 2023). Technologies like digital platforms and apps, e-commerce and digital trade, and AI are expected to result in significant labour market disruption and job displacement and will be key drivers of business transformation. It is thus important that students and graduates entering the workplace know how to learn, how to adapt in changing circumstances, and know how to be independent and take the initiative when required. Self-directed learning (SDL) prepares students for these challenges.

A key goal of higher education is to prepare graduates to be self-directed lifelong learners with the ability to continuously learn, unlearn and relearn to keep pace with the rapidly transforming industry needs. It is recognised as one of the critical 21st Century skills for life and career (Partnership for 21st Century Skills, 2007). In the CDIO syllabus, the skills of self-directed learning are reflected in 2.4.6 (Self-awareness, Self-reflection, Metacognition and Knowledge Integration), 2.4.7 (Learning Agility, Lifelong learning and Educating) and 2.4.8 (Time and Resource Management) in the category "Attitudes, Thought and Learning".

In SP, "Self-directed Learning and Personal Responsibility" is one of the six graduate attributes that the institution aims to develop in its students. The institution has defined this graduate attribute as:

"Ability to manage own learning, learn how to learn, seek opportunities for lifelong learning, and achieve work and life goals while maintaining overall well-being." (Singapore Polytechnic, 2020).

With the various definitions in mind, SP proposed a SDL framework (Figure 1) that involves 2 key components (Leong et al, 2019):
1. Motivational or mindset component which includes the students' motivation and self-belief about themselves as learners; and
2. Cognitive or skills set components which includes the cognitive and metacognitive learning strategies that learners use.

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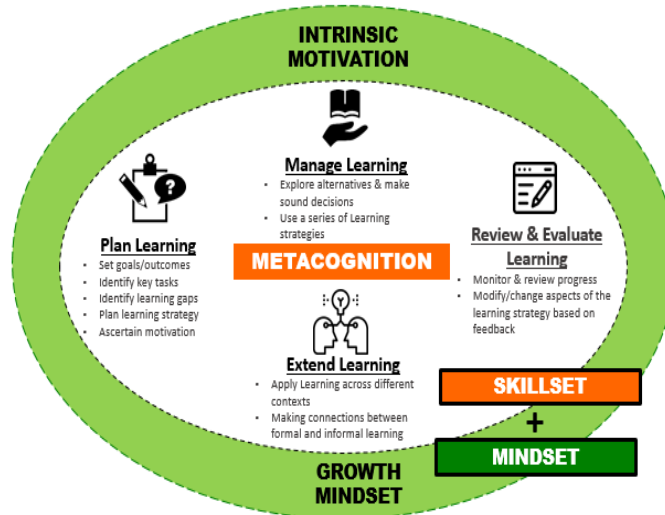
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Figure 1. Singapore Polytechnic's Self-directed Learning Framework

According to Brandt (2020), pedagogical approaches promoting self-directed learning typically support choice and personalisation, agency, responsibility, collaboration and peer support. Such pedagogical approaches include project-based learning, self-assessment and online and distance learning. In these approaches, the teacher plays a facilitating and scaffolding role while the student carries out personalised activities to develop and demonstrate SDL competencies. Tan & Koh (2014) wrote that "for self-directed learning experiences to be effective, teachers need to carefully structure the task environment to provide sufficient scope for students' self-direction" (p. 16-17) and one of the ways highlighted was the case of flipped learning. Abeysekera & Dawson (2014) also proposed that flipped learning might improve student motivation and help manage cognitive load.

In SP's implementation of Flipped Learning, all face-to-face lectures are converted to self-paced asynchronous online lesson packages. Studying a flipped learning module requires students to use self-directed learning strategies to review and comprehend the learning materials before class. Quizzes are embedded into these lesson packages to check students' understanding as well as to get them to reflect on their learning as they progressed. The students' quiz attempts provide lecturers with data to differentiate their tutorial activities for different learning abilities. During face-to-face tutorials, students actively apply their knowledge in lesson activities customised to their level of understanding and learning abilities. For example, lecturers could conduct mini-lectures on topics that majority of students found difficult or divide the class into groups to carry out differentiated team-based learning activities.

In addition to the Flipped Learning approach, in some modules, lecturers teach the skills of SDL explicitly. Wong and Cheah (2022) from the School of Chemical and Life Sciences, reported the use of the Plan, Select, Monitor and Evaluate process spelt out in the SP SDL Framework (Figure 1) to explicitly teach and emphasise SDL and metacognition in their year 1 Laboratory and Process Skills module in the Diploma of Chemical Engineering. In the first session of the module, lecturers modelled the SDL process by verbalising the thought process in tackling given tasks through a series of "talk-aloud" questions. Students, in turn, made their thought processes of their learning experience explicit in a journal. This process was emphasised in all 10 activities in the module. The results of a survey of the students SDL competencies showed that students were able to model the behaviour of a self-directed learner by planning, referring to previously learnt knowledge, monitoring and evaluating their work,

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and seeking help from friends when needed. The authors also reported that academically stronger students were more ready to take control of their learning as they struggled less to make sense of what they are learning, and therefore more confident to perform the learning tasks.

In this paper, the authors will share the efforts by Singapore Polytechnic (SP) to prepare our students to be self-directed learners. The paper will detail the study conducted in 2023 on the impact of flipped learning on students' SDL competences. The objective of the survey was to ascertain students' self-directed competencies in terms of their self-efficacy for learning and their use of different learning strategies. The findings will inform the institution on the support to provide to students. The paper will share the learnings gained from the study.

A PRELIMINARY SURVEY OF STUDENTS' SDL COMPETENCE

Objective

In April 2022, Flipped Learning was instituted across all SP's programmes. By early 2023, all SP students would have at least one semester where lessons with lecture components were taught in the flipped learning modes. As a preliminary check on its impact on students' learning, a survey to study students' SDL competences was administered to all students at the end of the academic year in Feb 2023. The objective of the survey was to ascertain students' self-directed competencies in terms of their self-efficacy for learning and their use of different learning strategies.

Methodology

The survey adopted 20 questions from 2 components of the Motivated Strategies for Learning Questionnaire (Pintrich, 1991); the "Self-Efficacy for Learning & Performance" (SE) and "Metacognitive Self-Regulation" (MSR) scales. The MSLQ instrument was selected as it is a validated questionnaire whose scales could be used singly. In addition, given the concern of students' "survey fatigue", the number of items in each scale were reasonable. The survey was administered through a web-based survey application. Student participation in the survey was voluntary and anonymous.

Findings

1106 students or about 8.9% of the full-time diploma students in SP participated in the survey. Figure 2 shows the distribution of respondents by year of study.

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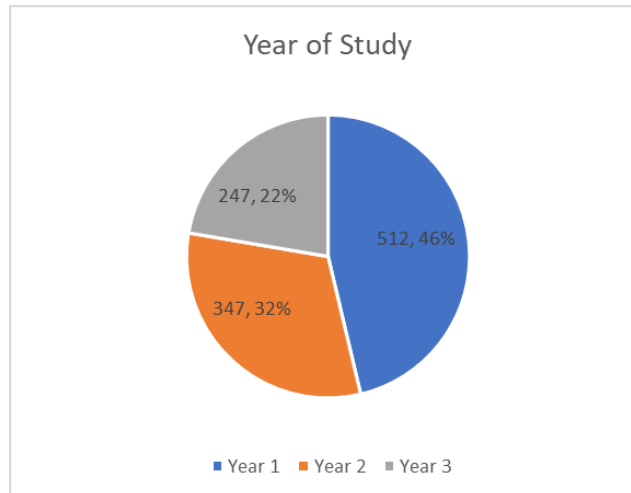
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Figure 2. Distribution of 1106 respondents by year of study

Table 1 shows the findings for the Self-Efficacy for the Learning and Performance (SE) Scale. The mean scores of the SE scale ranged from 4.3 to 5.4 with an overall mean of 4.8 (SD = 1.5). The Cronbach alpha was 0.944 which showed an excellent internal consistency in the student responses. The table shows that about two-thirds of the respondents perceived themselves to be confident of learning the concepts taught in their flipped learning modules (68% reported somewhat true to very true, mean = 5.0, SD=1.5) and believed that they can receive an excellent grade (62% reported somewhat true to very true, mean= 4.8, SD = 1.6) for their flipped learning modules. In particular, 80% of the respondents perceived themselves as confident when it comes to learning the basic concepts taught in their flipped learning modules (80% reported somewhat true to very true, mean =5.4, SD=1.3).

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Table 1. Results for Self-Efficacy for the Learning and Performance (SE) Scale

Measure	Questions	Scores (%)							Mean	Std Dev
		1	2	3	4	5	6	7		
Ability	I expect to do well in my flipped learning modules.	4	3	8	18	27	23	18	5.0	1.5
	I believe I can receive an excellent grade in my flipped learning modules.	5	4	10	19	27	22	13	4.8	1.6
	Considering the difficulty of the modules, the lecturers, and my skills, I think I will do well in my flipped learning modules.	5	4	9	22	30	20	11	4.7	1.5
Confidence	I'm confident I can learn the basic concepts taught in my flipped learning modules.	1	2	4	14	27	28	25	5.4	1.3
	I'm certain I can master the skills being taught in my flipped learning modules.	4	3	10	22	30	20	11	4.8	1.4
	I'm confident I can do an excellent job on the assignments and assessments in my flipped learning modules.	4	4	9	23	29	21	11	4.7	1.5
	I'm confident I can understand the most complex material presented by the lecturers in my flipped learning modules.	7	7	13	21	26	17	8	4.3	1.6
	I'm certain I can understand the most difficult material presented in my flipped learning modules.	8	7	14	22	26	14	8	4.3	1.6
Overall		5	4	10	20	28	20	13	4.8	1.5

Cronbach's α=0.944 (Excellent Internal Consistency)

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Table 2. Results for Metacognitive Self-Regulation (MSR) Scale

Measure	Questions	Not at all true → somewhat untrue			N	Somewhat true → Very true			Mean	Std Dev.
		1	2	3	4	5	6	7		
Planning	Before I study new flipped learning module material thoroughly, I often skim it to see how it is organized.	7	6	11	18	25	16	18	4.7	1.7
	When I study for my flipped learning modules, I set goals for myself in order to direct my activities in each study period.	5	7	10	23	25	15	15	4.6	1.6
	I try to think through a topic and decide what I am supposed to learn from it rather than just going through the materials when studying for my flipped learning modules.	6	7	13	25	26	13	10	4.4	1.6
	When studying for my flipped learning modules, I make up questions to help focus my learning.	8	11	17	23	21	11	9	4.0	1.7
Monitoring	When I become confused about something I'm studying for my flipped learning modules, I go back and try to figure it out.	2	2	6	16	27	24	24	5.3	1.4
	When studying for my flipped learning modules, I try to determine which concepts I don't understand well.	1	1	6	17	32	23	19	5.2	1.3
	I ask myself questions to make sure I understand the material I have been studying in my flipped learning modules.	4	7	12	24	25	15	14	4.6	1.6
	I often find that I have been studying for my flipped learning modules but don't know what it was all about. (R)	11	11	22	21	15	13	7	3.8	1.7
Regulating	If I get confused taking notes in my flipped learning modules, I make sure I sort it out afterwards.	3	4	8	19	26	20	19	5.0	1.5
	I try to change the way I study in order to fit my flipped learning module requirements and the lecturer's teaching style.	4	7	12	22	27	16	12	4.6	1.5
	If my flipped learning module materials are difficult to understand, I change the way I study the material.	4	6	12	24	26	14	13	4.6	1.5
	When studying for my flipped learning modules, I often miss important points because I'm thinking of other things. (R)	10	12	19	18	17	16	8	4.0	1.8
Overall		5	7	12	21	24	16	14	4.6	1.6

Cronbach's α=0.823 (Good Internal Consistency)
(R): Reverse question, responses are reversed

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Table 2 shows the findings for the Metacognitive Self-Regulation Scale (MSR) scale. The mean scores of the MSR ranged from 3.8 (reversed question) to 5.4 with an overall mean of 4.6 (SD = 1.6). The Cronbach alpha was 0.823 which showed good internal consistency in the student responses. The table shows that slightly more than half of the student respondents perceived that they plan, monitor and regulate their learning activities when learning their flipped learning modules (54% reported somewhat true to very true). The students reported that they tended to monitor their learning by trying to figure out confusing material (75% reported somewhat true to very true, mean = 5.3, SD = 1.4), and material that they do not understand well (74% reported somewhat true to very true, mean = 5.2, SD = 1.3) and sorted out their notes if they get confused (65% reported somewhat true to very true, mean = 5.0, SD = 1.5).

Table 3 shows that the correlation of the 2 SE and MSR constructs (r= 0.58, significant at 5% α) was moderate. We can infer that students believe that they have the ability to do well in the flipped learning modules and are confident in their skills. This positivity influences them to carry out SDL activities that help them to plan, monitor and regulate their own learning.

Table 3. Correlation of the SE and MSR constructs

Construct	Mean	Correlation
Self Efficacy for Learning & Performance	4.8	r = 0.58* (significant @5% α)
Metacognitive Self-Regulation	4.6	

*One-tailed t-test conducted, p-value <0.05. Reject H_0 of correlation ≤ 0

CONCLUSION AND MOVING FORWARD

The institutional adoption of flipped learning for modules with lecture components in 2022 required students to be self-directed and take ownership of their learning. In a survey conducted in February 2023, the students perceived themselves as confident of learning concepts taught in their flipped learning modules and believed that they have the ability to do well. They adopted strategies like self-assessment and questioning that helped them monitor how well they understood the material. As flipped learning is the major institution-wide pedagogy implemented in recent years, the findings from the study indicated that it did not have any adverse impact on students' motivation and strategies for learning and could have contributed to the development of these competencies.

The findings of the study, however, have limitations as there was only one survey conducted. 1106 or 8.9% of the student population responded to the survey. While the data provided the institution with a preliminary indication of the students' SDL competences, it may not be representative of the student population. More data is needed. More insights could be drawn if there were pre-test or previous years' data available for comparison. The flipped learning pedagogy implementation across the modules ranged from 5 years to one semester. Also, in some modules, the SDL skills was explicitly taught and scaffolded while in others, students' SDL experiences were not scaffolded. This inconsistent implementation may have also impacted the lecturers' experience and expertise in implementing SDL activities and hence, students' experiences and development. The study was also limited to 2 dimensions: 'Self-Efficacy for Learning' and Metacognitive Self-Regulation. Other dimensions of SDL like intrinsic motivation, personal responsibility, and growth mindsets were not included in the study. There were also no qualitative data from interviews or student reflections in this study to

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provide deeper insight and anecdotal evidence, hence limiting the conclusions that can be drawn.

Moving forward, a detailed mixed methods research study will be carried out in 2024 to further investigate the impact of the institution-wide implementation of flipped learning pedagogy involving surveys and in-depth interviews with students on their self-directed learning activities as well as interviews with lecturers on their teaching and learning approaches to support students during flipped learning.

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BIOGRAPHICAL INFORMATION

Helene Leong is Singapore Polytechnic Education Consultant and the former the Director of the Department of Educational Development. As Director, she led educational initiatives and professional development programmes which focused on CDIO, Flipped Learning, Self-Directed Learning and Analytics in Education in the polytechnic. She is currently leading a poly-wide multi-year project on Self-Directed Learning and how it can be assessed and developed. She is currently the co-chair of the CDIO council and former co-leader of the Asian CDIO region (2011-2022).

Mei Yee Chan is the Director at the Department of Educational Development, Singapore Polytechnic. She was involved in the initial conceptualisation of Flipped Learning, the subsequent pilot implementation in 2015, the scaled-up implementation to all modules with lecture component by 2022, and the various evaluation studies on Flipped Learning. She has more than 20 years of experience working on technology projects for knowledge management and for teaching and learning. Mei Yee holds an MSc in Information Studies (Information Management) from Nanyang Technological University, Singapore.

Gavin Bryan Lee is currently pursuing his doctorate and holds an M.Ed. degree. He is a Senior Education Advisor at Singapore Polytechnic and is leading research evaluations on pedagogies such as flipped learning, data-enabled learning and innovative classrooms. He has lectured and taught students on communication skills in several universities and his research interests are flipped learning, learning analytics and personalised instruction.

Chong Siew Kee holds an M.Ed. degree and is an Assistant Manager from Academic Quality & Resources (AQR) at Singapore Polytechnic. She worked closely with lecturers to integrate educational technology and pedagogy in their lessons to enhance learning experiences and outcomes. She has implemented flipped learning, team-based learning, and asynchronous lecture initiatives in SP.

Loh Kian Chee holds a BEng in Engineering Systems and Design. He is an Educational Technologist at Singapore Polytechnic and used to work as a data analyst. He works closely with researchers and lecturers to research online student learning, builds dashboards to improve teaching and learning, and coaches lecturers to better use the learning management system

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