FLIPPED LEARNING TO FOSTER STUDENTS' SELF-DIRECTED LEARNING: A STUDY OF FIRST YEAR STUDENTS' SELF-DIRECTED LEARNING COMPETENCIES

Mei Yee Chan[1], Gavin Bryan Lee[1], Kian Chee Loh[1], Helene Leong[2]

Department of Educational Development[1], Academic Cluster[2], Singapore Polytechnic

ABSTRACT

A key goal of higher education is to cultivate self-directed, lifelong learners who can adapt to dynamic industry demands through continuous skill refinement and learning. To support this goal, Singapore Polytechnic has implemented Flipped Learning across all its programs. This learner-centered approach requires students to engage with online materials independently, fostering responsibility for preparation and understanding. By promoting essential Self-Directed Learning (SDL) skills, Flipped Learning equips students for academic success and lifelong adaptability. In 2023, the institution launched a study to evaluate the impact of Flipped Learning on students' SDL development over three years (2023 – 2026). Using the Motivated Strategies for Learning Questionnaire and student interviews, this paper presents early findings of the study involving 1188 first year students, revealing that the institution's first year students perceive flipped learning as beneficial, feel confident in their learning abilities, and adopt strategies like checking with peers and looking for resources. These findings aim to promote understanding of Flipped Learning's role in developing SDL in higher education and provide actionable insights for educators and policymakers.

KEYWORDS

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

INTRODUCTION

In an era of rapid technological advancements and evolving workforce demands, the ability to be independent and adaptive learners has become a critical skill for success. Higher education institutions are increasingly tasked with preparing graduates to be self-directed lifelong learners capable of navigating complex and uncertain environments. Recognising this need, Singapore Polytechnic (SP) implemented and leveraged on flipped learning as an institution-wide pedagogy to foster SDL competencies in students (Leong et al., 2019). Flipped learning, also referred to as the flipped classroom model, reverses the traditional instructional approach by shifting content delivery outside the classroom, often through online resources such as videos (Aidoo et el., 2022). In-class time is dedicated to interactive and application-based activities (Kurbanoğlu & Akkoyunlu, 2017). In this model, students engage with instructional material independently before class (Tsai, 2021), while classroom sessions focus on activities such as problem-solving, discussions, and collaborative projects (Hwang et al., 2015). This approach allows educators to create more dynamic and student-centered learning environments, providing opportunities for timely and targeted support during in-class activities (Lo & Hew, 2021).

This paper presents preliminary findings from first year students at the beginning of their 3-year course from 2023 to 2026 and builds on Leong et al. (2024) which began exploring the impact of flipped learning on SDL competencies. The earlier study provided valuable insights into students' perceptions of their learning strategies and self-efficacy. It highlighted the potential of flipped learning to enhance SDL but the study was limited in scope and duration as compared to the current research. This study delves deeper into the effects of this pedagogical approach and adopts a mixed methods approach. A quantitative survey was employed to examine students' motivation for learning and their use of various learning strategies, complemented by qualitative data from semi-structured interviews. The preliminary findings provide insights to guide the institution in enhancing support for students and improving their learning experiences. It is important to note that the study does not examine the relationship between students' self-directed learning (SDL) competencies and their academic performance, as the focus is on understanding SDL development rather than measuring academic outcomes. This paper also conveys key takeaways from the study thus far, contributing to the understanding of SDL development in higher education.

LITERATURE REVIEW

A key benefit of flipped learning is its potential to enhance SDL skills (Kim & Lim, 2021). By requiring students to take responsibility for engaging with preparatory materials, the model encourages the development of essential skills such as self-regulation, time management, and critical reflection (Öztürk, & Çakıroğlu, 2021). A study by Alsancak and Ozdemier (2018) examined the impact of flipped learning on students' SDL readiness and findings showed that there was a significant difference for the experimental group versus the control group in terms of motivation and SDL readiness. Additionally, the classroom activities potentially promote deeper understanding through active participation and peer collaboration (Steen-Utheim & Foldnes, 2018). Despite these advantages, successful implementation depends on thoughtful planning and addressing challenges such as varying levels of student readiness, motivation and access to online resources (O'Flaherty & Phillips, 2015; Tomas et al., 2019). With careful design and execution, flipped learning can serve as a valuable tool for fostering SDL in diverse educational settings.

The topic of self-directed learning has been explicitly documented in the CDIO syllabus version 3.0 under the subcategory “Learning Agility, Lifelong Learning and Educating” (Malmqvist et al, 2022). Topics relevant to SDL in this subcategory include:

- The motivation for continued self-education
- The skills of self-directed learning
- Learning from experiences through reflective practice
- Flexibility in one’s learning approaches
- Enabling learning in and from others

Reflection of experiences play a key role in the development of self-directed learning. Bolm et al (2023) reported the importance of incorporating reflection activities and assignments into the curriculum of a Bachelor of Architecture, Urbanism and Building Sciences in the Netherlands to promote self-directed learning. Teacher behaviours are also important in promoting self-directed learning. Cabo and Klaassen (2019), for example, reported a study of teacher cues on self-directed learning in math education that there are possible relations between the teachers’ behaviour and perceived cues by students and their active engagement when blended learning is adopted. The teacher made a difference in stimulating self-regulation and influencing how independently and actively students engaged in their learning.

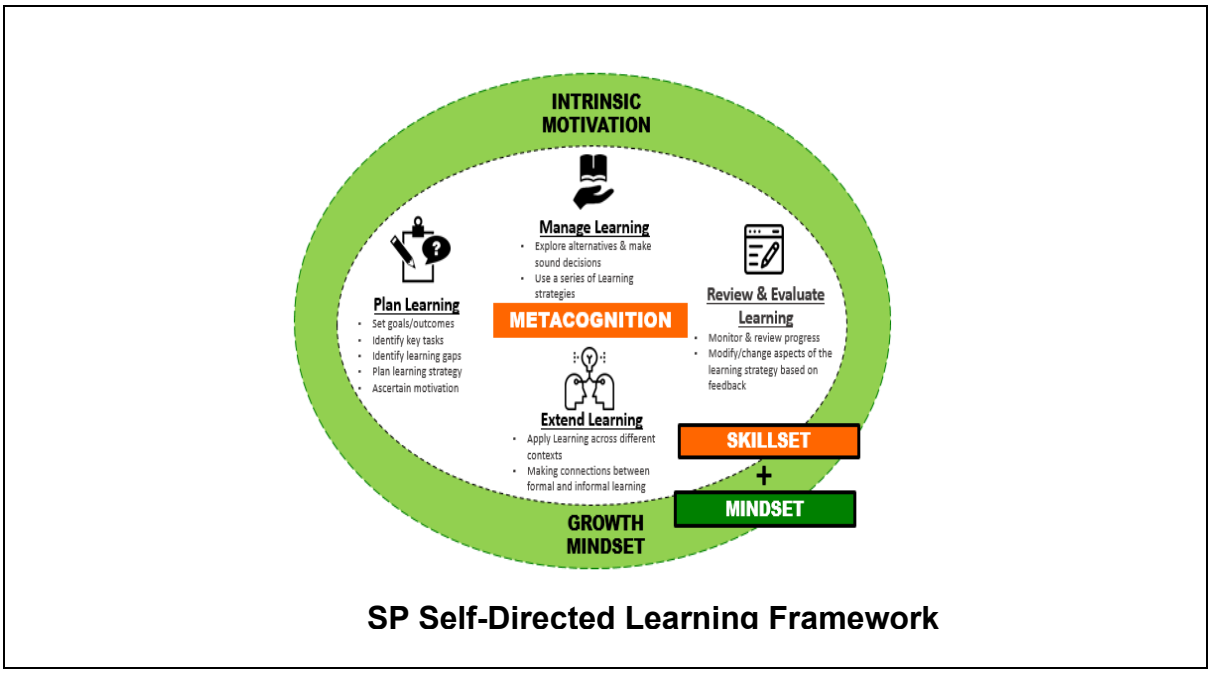

Figure 1: Singapore Polytechnic’s Self-directed Learning Framework

In SP, the curriculum has been redesigned to promote the development of self-directed learning competencies with flipped learning. An SDL framework (Figure 1), which provides the theoretical background consisting of 2 key components, has been adopted:

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.

METHODOLOGY

Quantitative Phase

The objective of the survey was to ascertain the development of students' self-directed competencies in terms of their motivation for learning and their use of different learning strategies. Pintrich's (1991) Motivated Strategies for Learning Questionnaire (MSLQ) was used for this study. It uses a 7-point Likert scale to capture nuanced differences in student motivation and learning strategies. A 7-point scale provides a wide range of options that enables participants to express varying degrees of agreement (Strongly Agree:7) or disagreement (Strongly Disagree: 1) and improves the sensitivity and reliability of the data. The MSLQ instrument was selected as it is a validated questionnaire whose components could be used singly and it has been used in a number of similar flipped learning studies that investigated SDL development.

A total of 34 questions were adopted from MSLQ. 12 questions were adopted from 2 components of the "Motivation" scale: "Self-Efficacy for Learning & Performance" and "Control of Learning Beliefs". 22 questions were adopted from 3 components of the "Learning Strategies" scale: "Help-Seeking", "Elaboration" and "Metacognitive Self-Regulation (MSR)". The survey was administered through a web-based survey application to all 4053 first-year students towards the end of the academic year. Student participation in the survey was voluntary but not anonymous to ensure the tracking of individual data throughout the duration of the study. Participants were informed of their right to withdraw from the study at any time without penalty, and care was taken to avoid any potential coercion or undue influence. To safeguard participant privacy, all data were securely stored and accessible only to authorised researchers. Identifiable information was coded and anonymized during analysis.

Qualitative Phase

The objective of the interviews was to get further insight into the quantitative results by gathering the personal experiences and reflections of students who experienced flipped learning. Students were selected from criteria such as entry scores, mid-semester test scores and prior educational backgrounds. The semi-structured interview questions were developed based on the SP SDL framework. Individual interviews were conducted online by the researchers and the recordings were transcribed verbatim for thematic coding. Participants were assured that their responses would be kept confidential, and all identifiable information was removed or coded during the transcription and analysis process to protect their privacy. Data were securely stored and accessible only to the research team. Efforts were made to minimise potential discomfort or stress during the interviews, and participants were given the opportunity to review and clarify their responses if needed.

PRELIMINARY FINDINGS

The survey received 1188 responses or about 29.3% of the 4053 first-year full-time diploma students in SP participated in the survey. There was representation from all courses within the institution. Figure 2 shows the findings for all MSLQ components.

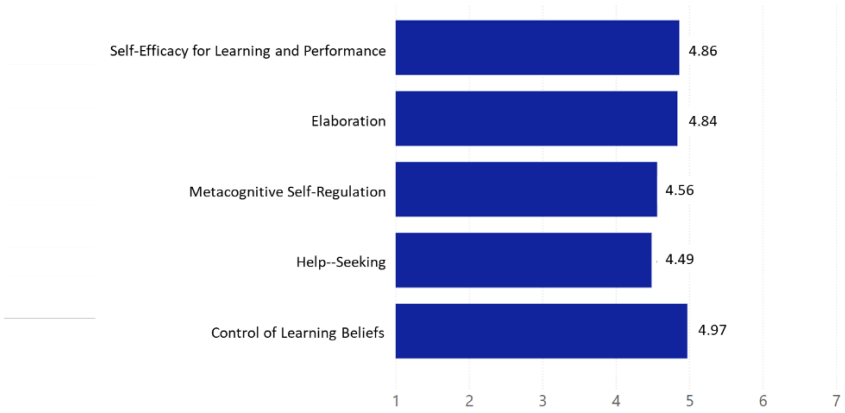

Figure 2: Results for all MSLQ Components

The figure shows that respondents rated themselves highest when it comes to being in Control of Learning Beliefs, followed by Self-Efficacy for Learning and Performance, and lowest for Help-Seeking. Figures 3, 4 and 5 show the detailed findings for these components.

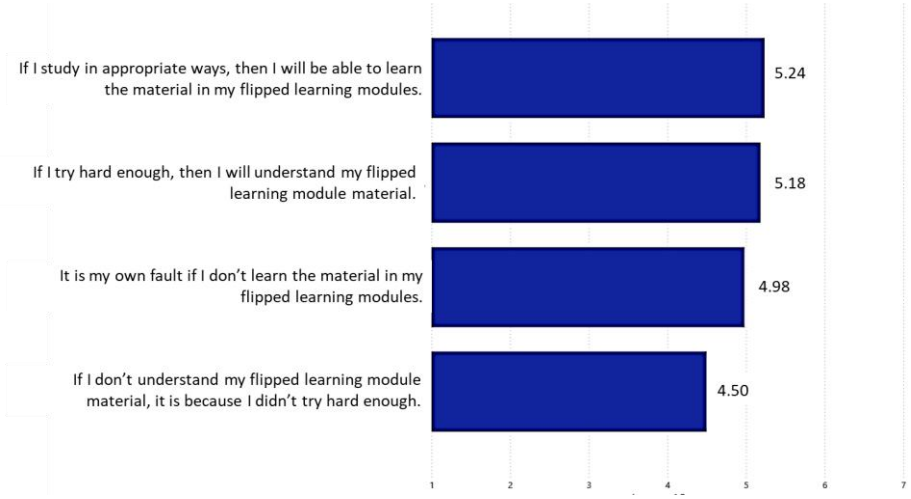

Figure 3: Results for the Control of Learning Beliefs scale

Figure 3 shows the findings for the Control of Learning Beliefs (CLB) scale. The mean scores of the CLB scale ranged from 4.50 to 5.24 with an overall mean of 4.97 (SD = 1.5). The Cronbach alpha was 0.879 which showed good internal consistency in the student responses. The figure shows that that most of the student respondents believe that studying in appropriate ways will enable them to learn the material (mean = 5.24) but if they did not understand the material, it was not their fault (mean = 4.98) and it was not because they did not try hard enough (mean = 4.50).

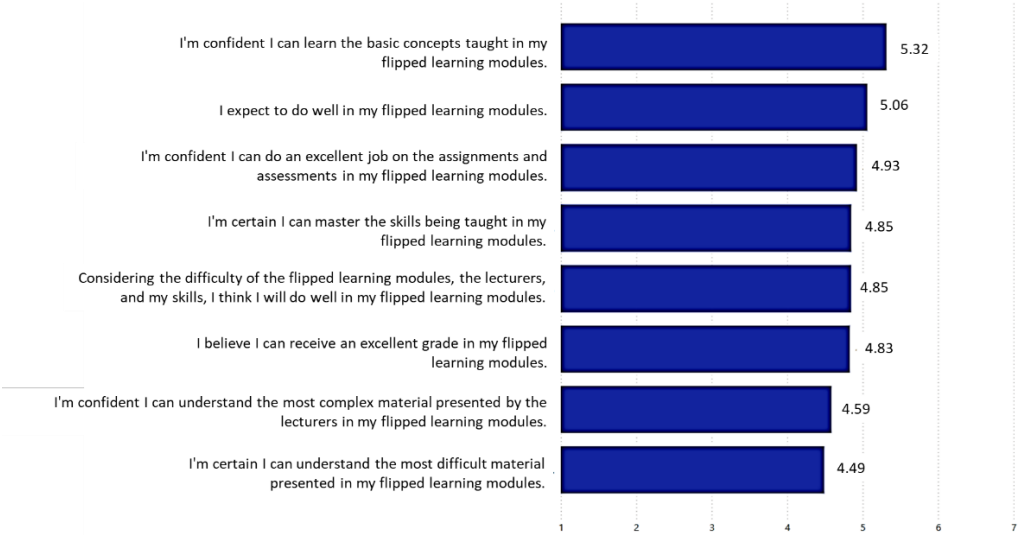

Figure 4: Results for the Self-Efficacy for Learning and Performance Scale

Figure 4 shows the findings for the Self-Efficacy for Learning and Performance (SE) scale. The mean scores of the SE ranged from 4.49 to 5.32 with an overall mean of 4.86 (SD = 1.4). The Cronbach alpha was 0.964 which showed excellent internal consistency in the student responses. The figure shows that that most student respondents perceived themselves to be confident of learning the basic concepts taught in their flipped learning modules (mean = 5.32) and expect to do well (mean= 5.06) for their flipped learning modules. However, respondents perceived themselves as least confident when it comes to learning the most complex concepts and most difficult material in their flipped learning modules (means= 4.59 and 4.49).

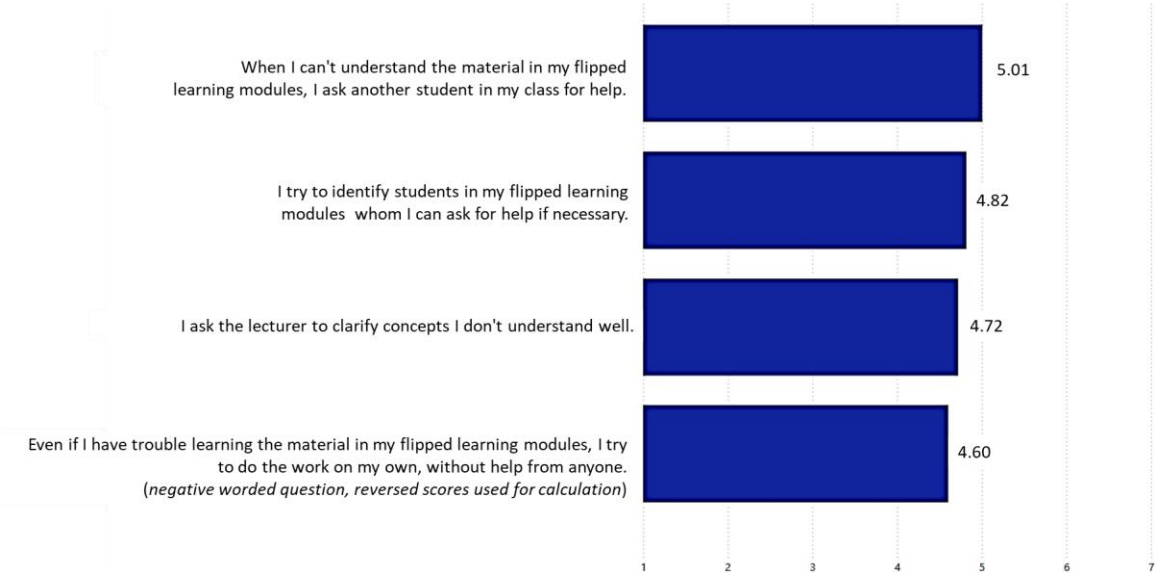

Figure 5: Results for the Help-Seeking Scale

Figure 5 shows the findings for the Help-Seeking scale. The mean scores of the MSR ranged from 4.60 to 5.01 with an overall mean of 4.97 (SD = 1.7). The Cronbach alpha was 0.755 which showed acceptable internal consistency in the student responses. The figure shows that for help-seeking practices, most student respondents perceived that they would ask another student in class for help (mean= 5.01 and 4.82), followed by asking their lecturers (mean= 4.72).

34 students were interviewed during the qualitative phase of this study. Students were nominated by their lecturers based on their academic performance, selecting both high-performing and underperforming students to capture a balanced range of perspectives and experiences. Thematic coding of the interview transcripts was carried out to triangulate with the MSLQ findings and gain further insight with anecdotal evidence.

The survey results showed that most student respondents believed that using effective study methods would help them learn the material. This was supported by qualitative findings, where many interviewed students reported improving their learning strategies in the flipped classroom. The two most common practices mentioned were seeking additional resources (n=25) and discovering new study methods (n=11).

Student 1 said this when asked how he engaged with resources to learn the materials:

"I only started using AI after I came to this school. I realised it helps a lot. And for research, I've never actually went to watch, like online videos last time, but now I do when I don't understand anything online. I'll just search Google and then I watch a YouTube video to see the visuals then I will understand it better."

Student 2 described having to learn new ways to study before the in-class sessions:

"I think that by preparing myself before every class, I know what is to be expected. And this helped me to take better notes…I think this also helped me to have a deeper understanding of the topic because I don't spend hours trying to memorise and understand the theories that are being taught in class but rather think of how I'm going to apply these skills in my future projects."

The online learning content being too difficult (n=8) is a possible reason uncovered from the qualitative analysis as to why many student respondents perceived more difficulty in understanding complex and difficult material and perceived that if they did not understand the material, it was not their fault. As Student 3 shared:

"So I had a lot of clarification that I needed to do with my friends and my teachers after that, because the content in the smart book wasn't very easy to understand, and there wasn't like any other video content that we could listen to actually clarify further"

The qualitative findings also corroborated the more common help-seeking practices shown by the survey findings as more student respondents reported they would check with their peers (n=13) and with their lecturers (n=11).

Student 4 had this to say about checking with peers:

"I always consult with my classmates and my friends. And always see like how, like how they have done a certain project. And I want to see the difference. What am I missing? What am I doing that is not the same? So I want to see the difference."

Student 5 explained the rationale and the benefits for checking with the lecturer:

"I also feel that checking in with my lecturer is a way to validate because during every normally there's an intermission during class. And how I will check my learning is by giving my lecturer a short recap about what I've learned. And if the lecturer feels that I missed out

some pointers, he will also highlight whether my understanding is correct or wrong. And I think this has really helped me over the past year."

DISCUSSION AND CONCLUSION

The findings from this study reflect first year students' initial experiences of and adaptations to flipped learning but further analysis over time will offer a deeper understanding of how these trends evolve. The survey revealed that first year students felt most confident in their control over learning beliefs and self-efficacy for learning and performance, but less confident when it came to help-seeking. The qualitative findings supported these trends, highlighting that students have adopted various strategies such as seeking additional resources (e.g., AI tools and online videos) and learning new study methods. However, the challenges reported with complex content and the continued reliance on peer and lecturer support suggest that their learning strategies are still developing. While challenges with difficult and complex content persist, help-seeking practices are important for overcoming such difficulties

As this study is part of a long-term study, future phases of data collection will provide a clearer picture of how students' motivation, self-regulation, and learning strategies change over time, offering deeper and long-term insights into the potential of flipped learning for students' SDL development.

Despite the promising results, the study has limitations. Firstly, self-reported survey responses may introduce biases, as students' perceptions of their learning competencies might not fully align with their actual behaviors. Another possible limitation could be the delivery of flipped learning by lecturers. Variations in lecturers' competencies in designing and facilitating flipped classroom activities may have influenced the consistency and effectiveness of the student learning experience. Finally, the initial phase of the study primarily captures short-term effects of flipped learning, with longer-term impacts yet to be examined in subsequent phases of the research. The study also does not include a comparison of SDL development with academic performance, highlighting an area for further investigation.

The research study will continue with the same cohort of students to further explore the effects of the institution-wide adoption of flipped learning pedagogy. Annual surveys will be administered in their remaining two academic years to track SDL development, complemented by more interviews to understand students' actual practices.

ACKNOWLEDGEMENT

The authors would like to thank colleagues from the School of Math and Science for their invaluable assistance with this study.

FINANCIAL SUPPORT ACKNOWLEDGEMENTS

The authors received no financial support for this work.

REFERENCES

Alsancak Sirakaya, D., & Ozdemir, S. (2018). The effect of a flipped classroom model on academic achievement, self-directed learning readiness, motivation and retention. *Malaysian Online Journal of Educational Technology*, *6*(1), 76-91.

Bolm, N. L., Hoekstra, M. J., van den Burg, L. P. J, and Reincke, M. M. O (2023). Who am I learning to become? Integrating personal development in curriculum design. *Proceedings of the 19th International CDIO Conference, NTNU, Trondheim, Norway, June 26-29, 2023*

Cabo, Annoesjka & Klaassen, Renate (2019). The influence of teacher cues on self-directed learning in math education. *Proceedings of the 15th International CDIO Conference, Aarhus University, Aarhus, Denmark, June 25-27, 2019*

Hwang, G. J., Lai, C. L., & Wang, S. Y. (2015). Seamless flipped learning: a mobile technology-enhanced flipped classroom with effective learning strategies. *Journal of computers in education*, *2*, 449-473.

Kim, S. H., & Lim, J. M. (2021). A systematic review and meta-analysis of flipped learning among university students in Korea: Self-directed learning, learning motivation, efficacy, and learning achievement. *The Journal of Korean Academic Society of Nursing Education*, *27*(1), 5-15.

Kurbanoğlu, S. and Akkoyunlu, B., 2017. Information literacy and flipped learning. In *Pathways into Information Literacy and Communities of Practice* (pp. 53-84). Chandos Publishing.

Leong, H., Chan, M. Y. & Chong, S. K. (2019). Flipped Learning to Nurture Self-Directed Learners at Singapore Polytechnic. *Proceedings of the 15th International CDIO Conference, Aarhus University, Denmark, June 25-27, 2019*

Leong, H., Chan, M. Y., Lee, G. B., Loh, K. C., & Kee, C. S. (2024). Study of students' self-directed learning competencies at Singapore Polytechnic. *Proceedings of the 20th International CDIO Conference, Ecole Supérieure Privée d'Ingénierie et de Technologies (ESPRIT), Tunis, Tunisia, June 10–13, 2024.*

Lo, C. K., & Hew, K. F. (2021). Developing a flipped learning approach to support student engagement: A design-based research of secondary school mathematics teaching. *Journal of Computer Assisted Learning*, *37*(1), 142-157.

Malmqvist, J., Lundqvist, U., Rosen, A., Edstrom, K., Gupta, R., Leong, H., Cheah, S. M., Bennedsen, J., Hugo, R., Kamp, A., Leifler, O., Gunnarsson, S., Roslof, J. & Spooner, D. (2022). The CDIO Syllabus 3.0 - An Updated Statement of Goals. *Proceedings of the 18th International CDIO Conference, Reykjavik University, Reykjavik, Iceland, June 13-15 2022*

O'Flaherty, J., & Phillips, C. (2015). The use of flipped classrooms in higher education: A scoping review. *The internet and higher education*, *25*, 85-95.

Öztürk, M., & Çakıroğlu, Ü. (2021). Flipped learning design in EFL classrooms: implementing self-regulated learning strategies to develop language skills. *Smart Learning Environments*, *8*(1), 2.

Pintrich, P., Smith, D., Garcia, T., & McKeachie, W. (1991). *A Manual for the Use of the Motivated Strategies for Learning Questionnaire (MSL*Q). Ann Arbor, MI: University of Michigan, National Center for Research to Improve Postsecondary Teaching and Learning.

Steen-Utheim, A. T., & Foldnes, N. (2018). A qualitative investigation of student engagement in a flipped classroom. *Teaching in Higher Education*, *23*(3), 307-324.

Tomas, L., Evans, N. S., Doyle, T., & Skamp, K. (2019). Are first year students ready for a flipped classroom? A case for a flipped learning continuum. *International Journal of Educational Technology in Higher Education*, *16*(1), 1-22.

Tsai, Y. R. (2021). Promotion of learner autonomy within the framework of a flipped EFL instructional model: Perception and perspectives. *Computer Assisted Language Learning*, *34*(7), 979-1011.

BIOGRAPHICAL INFORMATION

Helene Leong is Singapore Polytechnic's 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.

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.

Corresponding author

Helene Leong
SP Education Consultant
Academic Cluster Singapore Polytechnic
500 Dover Road, Singapore 139651
Helene_Leong@sp.edu.sg