ACTIVE LEARNING COMMUNITY FOR PROFESSIONAL DEVELOPMENT: A CDIO STANDARD 10 IMPLEMENTATION MODEL

Geok Ling Soo-Ng, Zhengping Liow

School of Architecture and the Built Environment, Singapore Polytechnic

ABSTRACT

This study offers a qualitative investigation and implementation of Faculty Learning Communities (FLC) as enabler to support the operationalization of Conceive, Design, Implement and Operate (CDIO) Standard 10 which emphasizes the improvement of faculty teaching competence at the School of Architecture and the Built Environment (ABE) and the Singapore Maritime Academy (SMA) at the Singapore Polytechnic (SP). This implementation of the FLC approach, facilitated by a group of Teaching and Learning Mentors and Specialists (TLMS), takes the form of an Active Learning Community (ALC) aimed at fostering collaboration and professional development among teaching staff with activities like symposiums, monthly sharing sessions, book studies and curated hands-on workshops. The monthly ALC sessions cumulate as a large-scale 'Active Learning Symposium' (ALS) for staff from two schools. The 2024 ALS highlighted novel pedagogical strategies and assist academics in contextualising them into their teaching practices, highlighting the interdependent relationships of various Teaching and Learning (T&L) initiatives introduced over the years. Participants' reflections emerged as crucial themes related to pedagogy, teaching practices, and feasibility of pedagogical adaptation facilitated by CDIO standards 8 and 10 during the 2024 ALS. Participants also expressed cautious optimism, appreciation, commitment to development, and encouragement for data-driven initiatives, further reinforcing the potential of organising future large-scale symposiums with a strong focus on contextualising CDIO Framework in teaching strategies and curriculum development. The findings of this study highlighted the importance of bridging educational gaps and enhancing teaching effectiveness while ensuring congruence with the outcome-based education through the operationalisation of CDIO frameworks. This paper introduces a holistic approach and provides insights into implementing CDIO Standard 10 by practicing CDIO Standard 8 as a teaching method. It emphasizes how this collaborative learning method, emphasizing its potential to catalyse future transformative CDIO FLC in higher education teaching and learning.

KEYWORDS

Learning community, professional development, transformation, CDIO Standards 8 and 10.

BACKGROUND

In response to the challenge of enhancing teaching staff competence as per CDIO Standard 10, Soo-Ng (2020) from the School of Architecture and the Built Environment (ABE) at Singapore Polytechnic (SP) implemented a novel professional development model centered around the concept of a Learning Community (LC). This initiative evolved from the Action Research (AR) Group, created in 2009 to address ineffective lecture-based learning. However, the AR Group's task force approach lacked sufficient collaborative learning and ongoing support, leading to its reform. The transition to the Active Learning Community (ALC) was driven by the need for a more supportive, collegial environment, drawing on the principles of communities of practice (Wenger, 2002). By 2011, the ALC was firmly established, promoting active learning, out-of-class activities, and assessments. It supported professional development through book studies, reflective practices, symposiums, and peer-sharing sessions. This paper extends the ALC model's implementation, aiming to expand its principles to a broader academic context. The next phase focuses on operationalizing the ALC model, addressing challenges, and sharing experiences to foster a culture of continuous improvement and collaborative learning for both staff and students.

INTRODUCTION

Faculty Learning Communities (FLCs) stem from the LC model, adapting its collaborative framework to focus on teaching staff development (Richlin & Cox, 2004). Many are familiar with FLCs, as they are commonly used in institutions across the USA. They consist of cross-disciplinary academics who engage in long-term, frequent, and informal sharing activities. These communities aim to contextualize and integrate novel pedagogical approaches, foster professional growth, encourage pedagogical experimentation, and build a supportive academic community, addressing the complexities of modern education. In our context, we have named our FLC the Active Learning Community (ALC). From this point forward, the term ALC will be used in place of FLC.

Clavert et al. (2015) reported that traditional divisions between academic disciplines and different signature pedagogies can hinder the development and participation in ALCs. This is because these divisions often lead to differences in teaching approaches and objectives, creating potential misalignment between the goals of the disciplines and the collaborative goals of ALCs. Moreover, teaching staff with less influence within the academic hierarchy lack the authority and legitimacy to build a pedagogical research community (Zeng & Fickel, 2021). In a setting where teaching loads are growing and faculty members are naturally focused on research in within their domains, Chang (2017) advocated that the academics' participation in (pedagogical) learning communities can play a significant role in providing support to busy academics towards the adoption of emerging state-of-the-art pedagogical innovation.

This study discusses the impact and implications of participants' learning reflections and sentiments from the 2024 Active Learning Symposium (ALS) as reflective themes related to pedagogy, teaching practices, and its feasibility emerged. With the same dataset, participants' surfaced sentiments revolved around themes of cautious optimism, appreciation and gratitude, and commitment to developing students' soft skills through mediating disagreements and propensities towards data-driven pedagogical approaches. Although the trajectory of this pilot ALC did not explicitly propagate faculties' competencies in deploying CDIO standards, the encouraging findings of this pilot underscored the potential of organising future large-scale, cross ALC events in bridging educational gaps, enhancing teaching quality, and inducing academics to align their teaching practices with CDIO practices. Hence, this

study examined reflections and sentiments from large-scale ALC participants. The findings will guide future planning strategies to operationalise CDIO Standard 10, which focuses on enhancing faculty teaching competence. To support this, the study also explores how CDIO Standard 8, centered on active learning, can be adapted for faculty professional development in future CDIO ALC.

Active Learning Community (ALC) as an enabler of CDIO Standard 10

As faculty members aim to be proficient in using the CDIO approach to help students actively build knowledge, skills and attitudes, ALC is potential enabler of CDIO Standard 10 Enhancing Faculty Teaching Competence. Despite its potential in advancing pedagogical practices, CDIO Standard 10 is arguably the most overlooked, underdeveloped, and least documented (Edström, 2012). Cheah and Lee (2015) explicitly emphasised the vital role of ALC in maintaining CDIO Competencies with a mentoring framework as a response to the lack of emphasis given to faculty members' professional development. Thomson and Clark (2018) equally stressed the need to shift towards an evidence-based approach to Standard 10 that accentuates the importance of knowledge sharing in community settings as a gap that still needs to be addressed. Such trajectories have further reinforced the urgencies of harnessing ALC in facilitating pedagogical advancements.

ALC predicates on the works of John Dewey and Alexander Meiklejohn, whom both advocated for shared, practical learning. Their ideas have been widely adopted since the 1980s (Sicat et al., 2014). ALC emphasises and supports the institution's objective of enhancing the faculty's development of pedagogical competencies in achieving desired educational objectives (Reznik & Vdovina, 2018). Cox (2004) elucidated that ALC often consists of six to fifteen cross-disciplinary faculty members embarking on long-term and frequent informal sharing, activities to promote learning, development, teaching scholarships, and community building. These pedagogical learning communities provide a platform for faculty members to exchange ideas, engage in peer consultation and share best teaching practices, potentially broadening their impact. Furthermore, Pstross et al. (2017) elucidated that ALC's 'transformative moments' could serve as platforms for individuals to engage in continuous learning throughout their lives. Transformative learning utilises previous understanding and knowledge to create a fresh or updated interpretation of one's experiences in influencing future decisions and actions (Mezirow, 1996). Pstross et al. (2017) highlighted that the potential relationships between community building and lifelong learning experiences helps address the challenges posed by continuous societal changes through cycles of theory-building and reflective practices.

Experiential and Active Learning Methods: Operationalising CDIO Standard 8 To Support Standard 10

Experiential learning in the CDIO Framework is a student-centered, hands-on approach that promotes active participation, problem-solving, and the practical application of knowledge (Crawley, Malmqvist, & Östlund, 2014). It is guided through the stages of conceiving, designing, implementing, and operating solutions, helping students develop both technical and soft skills such as teamwork and communication. This complements CDIO Standard 8, which emphasizes engaging students in active thinking and problem-solving. The coherent integration of CDIO Standard 8 with Standard 10 is beneficial: educators are more likely to use active learning techniques after experiencing them in the collaborative and dialogical environment of the ALC workshops.

The call to evaluate faculty pedagogical approaches to enhance students' learning experiences through active learning has become increasingly important. Active learning

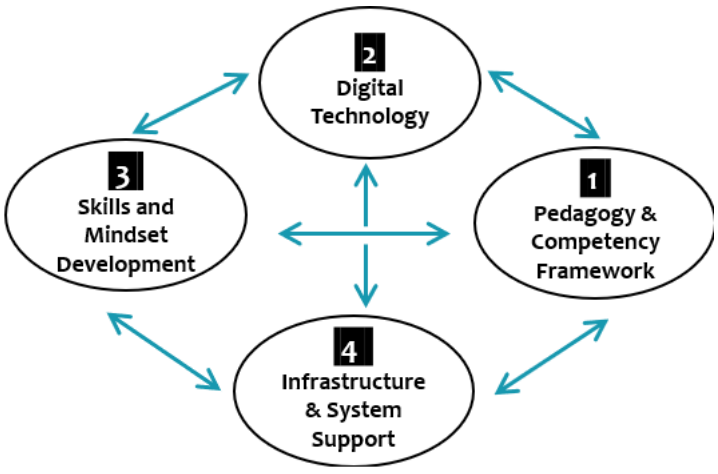
engages students in meaningful, hands-on learning rather than passive observation (Prince, 2004), immersing them actively in the process. Unlike traditional pedagogical models that stress passive memorization with teachers as sole authorities, Active Learning enhances teaching effectiveness, comprehension, engagement, and performance across disciplines, fostering a dynamic and interactive classroom environment (Coorey, 2016; Armbruster et al., 2009). Faculty members were encouraged to infuse interactive teaching/facilitation methods such as group discussions, problem-solving activities and hands-on exercises to foster deeper comprehension and critical thinking skills.

PROPOSED IMPLEMENTATION MODEL

Since 2011, ABE's Learning Mentors and Specialists (TLMS) have organized monthly ALC sessions for faculty. In 2022, SMA's TLMS also joined the monthly ALC session. These informal sessions foster collaboration and professional development through knowledge and pedagogical sharing, best practices, book studies, and tailored hands-on workshops. Beyond mere knowledge dissemination, the ALC focuses on contextualizing the institution's various educational initiatives. The sessions aim to enhance their teaching competence in designing, delivering, and improving curriculum courses by engaging faculty in hands-on activities grounded in Active Learning principles. ALCs' collaborative climate mirrored the ideas of a Community of Practice, with members engaging in shared learning and professional growth. As ALCs gain popularity, institutions should invest in faculty development and understand their experiences to ensure effectiveness (Stevenson et al., 2005).

ALC Symposium

At the conclusion of the academic year, the school of ABE and SMA will traditionally hold an Active Learning Symposium. The yearly symposium, echoing the monthly ALC sessions since 2011, serves as a reflective year-end event to share teaching initiatives and foster faculty collegiality. Specifically, the 2024 ALC symposium was designed to bridge the gap between the institution's seemingly 'disparate' educational initiatives (Figure 1a) and align them with the CDIO standards (Figure 1b).



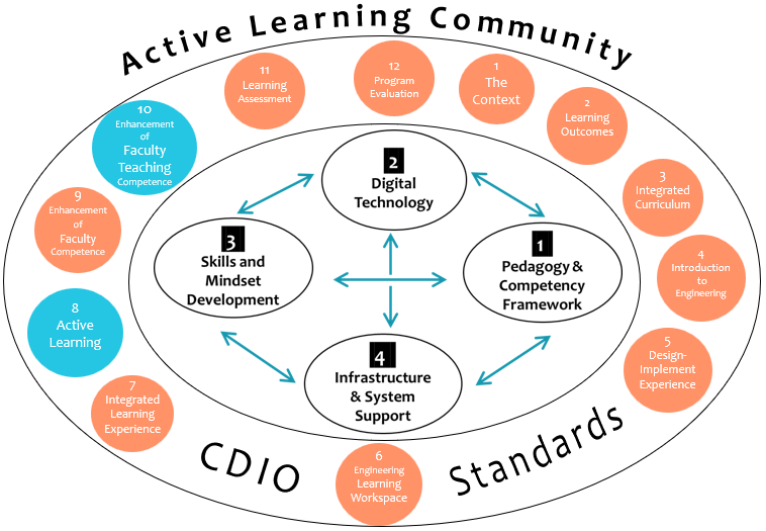
1. Pedagogy & Competency Framework
   - Analytics in Education (AiE)
   - Digital-to-the-Core (DTTC) Lecturer
   - Pedagogy for the Profession (P4P)
   - Data-Enabled Flipped Learning (DEFL)
   - Asynchronous Learning
   - Team Based Learning (TBL)
   - Differentiated Learning
   - CDIO

2. Digital Technologies
   - Generative AI (GenAI)
   - Industry Internet of Things (IIOT)
   - AR/VR/MR

3. Skills and Mindset Development
   - Teamwork Measurement (TM)
   - Self-Directed Learning (SDL)

4. Infrastructure & System Support
   - Learning Management System (LMS)
   - Classroom-of-the-Future (CotF)
   - Video Content Management System (VCMS)

Figure 1a. Educational Initiatives by the Institution.



Explanation:

This figure illustrates our cores and supporting interconnected T&L initiatives, driven by the CDIO approach.

This approach defines the 'what' through its syllabus and the 'how' through the 12 interrelated standards shown here. These standards are interrelated and delivered to teaching staff through standards 8 and 10 in a learning community model.

Figure 1b. Connecting the dots… Understanding Our Approach to Education Initiatives.

It was believed that making sense of various initiatives through the contextualisation of pedagogical efforts was essential to increase faculty awareness and relevance in their teaching practices. Scaffolding pedagogical initiatives' relevance in the context of faculties' own teaching practices potentially helps connect their work to their personal values, goals, and beliefs. The annual event was held on the 5th of March 2024 and was attended by 65 and 36 colleagues from ABE and SMA, respectively. The TLMS from both schools collaborated to identify two pedagogical initiatives (Figure 2) organized as two tracks for the 2024 symposium: Track 1 - Facilitating Teamwork Measurement Conversations and Track 2 - Mechanics of Data-Enabled Flipped Learning (DEFL).

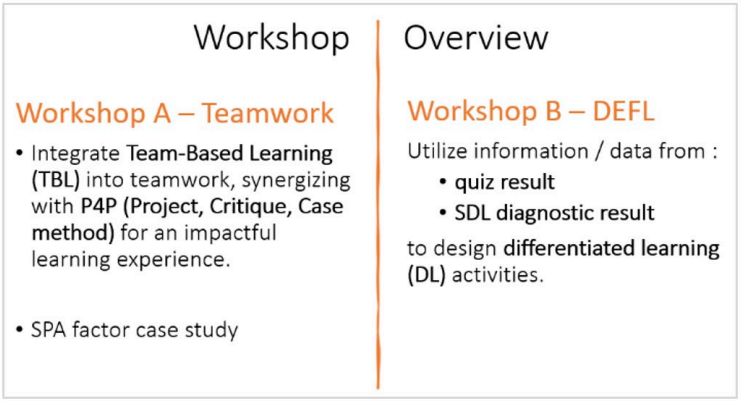


Figure 2. Two Tracks for the Symposium.

In the design of Track 1, TLMS from ABE and SMA collaboratively surfaced 'case studies' from their experiences for the participants to study real-life classroom problems on Teamwork based on different pedagogical scenarios and explore practical solutions through collaborative sharing and learning and thus enhance individual development in Teaching and Learning. This sharing of experiences offers participants a candid view of the Teamwork Measurement Pedagogy. More importantly, co-creating potential solutions in mediating conflict within student groups will be valuable in charting their pedagogical trajectories ahead.

In the design of Track 2, the mechanisms of DEFL were explored as an introductory session and concluded with a collective brainstorming activity. The central sharing investigated various challenges and addressed misconceptions that might have deterred faculty from adopting the DEFL model in their classes. Faculties from multiple programs collectively brainstormed how students' async quizzes can be harvested as data to support SP's DEFL model via an initial scan and analysis to identify current pedagogical/curriculum gaps contextualized in their diplomas.

As the initiatives detailed in both tracks were relatively new and had started to gain traction in both schools, building confidence and competencies were targeted as crucial outcomes for the participants. The two informal breakout sessions were conceived as 'safe' spaces for faculty to mingle informally as participants shared their experiences and challenges with these educational initiatives. The level of cross-pollination between different faculties from different schools will see significant levels of exchange as their experiences and anecdotes were built on foundations of camaraderie.

The critical mechanism and format of the annual ALC symposium support faculty members in implementing successful evaluation processes, congruent with the CDIO Framework's emphasis on outcomes-based education. By sharing assessment best practices and engaging in evaluation approach discussions, academics can ensure that their assessments assess the desired learning objectives and competencies outlined in CDIO standards. These notions explicitly support the operationalization of CDIO Standards 7 (Integrated Learning Experiences) and 8 (Active Learning), emphasising the importance of effective teaching and learning methods in engineering education (Red'ko & Shadrin, 2014; Tyflopoulos et al., 2021). ALCs help continuously improve teaching quality in engineering courses by allowing academics to engage in professional development, share ideas, and implement innovative instructional approaches (Red'ko & Shadrin, 2014). In addition, ALCs strongly support CDIO Standard 10, which emphasises the need to enhance faculty members' teaching practices and professional growth supported by Eib & Miller (2006).

EXPLORATION FRAMEWORK & RESULT

Feedback from the 2023 symposium revealed an overall satisfaction rate of 25% extremely satisfied, 55% very satisfied, and 20% somewhat satisfied. For the 2024 symposium, a qualitative framework was introduced to assess the effectiveness of ALC in fostering pedagogical strategies. Reflections and feedback from participants of the 2024 symposium were collected via a digital portal, highlighting experiences, challenges, and insights on teaching practices and professional growth. Three key themes were identified: Pedagogy and Student Quality, Teaching Practices, and Feasibility, summarized in Table 1, with general sentiments detailed in Table 2.

DISCUSSION & IMPLICATIONS

The ALC Symposium demonstrated the potential of large gatherings to bridge the gap between disparate educational initiatives and foster a cohesive understanding of pedagogical practices.

A key theme in Pedagogy and Student Quality was the faculty's recognition that the pedagogical strategies shared might not align with their signature pedagogy or universally improve student achievement. However, they acknowledged the potential for increased student motivation. This raised questions about how educators define 'academic success'—

whether it is based on academic performance or fostering intrinsic motivation for lifelong learning or other measurements. As Ekşi et al. (2020) noted, motivation is closely linked to lifelong learning, and faculty members' motivation to innovate in their teaching is positively associated with their drive for lifelong learning competence (Youngsun & June, 2019). Engaging in cross-faculty learning communities (LC) can further enhance faculty motivation, helping them experiment with new strategies and learn from colleagues' experiences.

Table 1. Pertinent Thematic Learning Reflections emerged from Thematic Analysis.

Pedagogy and Student Quality	**Teaching Process and Practices**	**Feasibility**
The pedagogies expounded (especially DEFL's Differentiated Learning) may not necessarily improve student quality but can benefit motivated students.	Effective teaching involves identifying, addressing gaps, and validating findings through a structured process.	Pedagogical approaches discussed are practical and can be implemented using various strategies and templates.
Participants' Reflections: *"DEFL may not improve students' quality. In addition, differentiated learning may help those who are motivated to pass a module (course)."*	**Participants' Reflections:** *"Teaching can be made more effective by following a process where discrete steps are taken to identify the gaps, address them and validate your findings."* *"The inclusion of a case study on the effects of the SPA factor (from self and peer assessments) was particularly valuable. It offered practical insights into how such evaluations can enhance team dynamics and individual accountability."*	**Participants' Reflections:** *"DEFL approaches and strategies. Templates to help guide us to design the interventions."*

The theme of Teaching Process and Practices has encouraged faculty to view their pedagogical efforts as structured processes of identifying gaps, addressing them systematically, and validating findings through reflective practice. Traditionally, educators' pedagogical knowledge has been introspective and incremental, often treated as private knowledge. Large-scale ALC provides a platform for sharing and articulating these experiences, practices, and new insights, promoting a deeper understanding of teaching methods (Mohamed et al., 2022). As faculties are constantly faced with the challenge of time, many may find that the discursive approach to reflection practices may be more feasible. The faculty may also take this opportunity to reflect on their pedagogical approaches and experiences.

Feasibility highlighted the positive reception towards implementing pedagogical approaches shared at the annual ALC Symposium. Time-constrained faculty appreciate the availability of tangible tools and templates to support new teaching methods. As Mezirow et al. (2014) noted, templates can be adapted for higher education, aligned with the course's pedagogical goals. Burgess et al. (2008) similarly recommended templates, noting that they help alleviate the stress of translating subject content into actionable strategies for active engagement. These

tools reduce workload and stress by providing a structured format for streamlining curriculum content, enabling faculty to identify areas for improvement and enhance student learning outcomes. Using templates was also explored by Leong (2021) of which the 'Evidence-based Reflective Practice' templates was administered to at-risk students. The structured templates predicted learning effectiveness before lessons and function as an interventive tool and data collection instrument.

Table 2. Participants' Sentiments

Cautious Optimism	**Appreciation and Gratitude**	**Commitment to Development, Mediating Disagreements and Conflicts in Teamwork Situations**	**Encouragement for Data-Driven Approaches**
There is a sense that while **DEFL** may not improve student quality universally, it is seen as a practical and doable approach with the right strategies and motivation.	Participants appreciated the opportunity to see how team-based learning strategies can be seamlessly integrated into teamwork development. Positive sentiments are expressed towards contributors and educators who shared their insights and experiences, indicating a supportive and collaborative community.	Despite cultural challenges, educators are committed to integrating **Teamwork** strategies and **DEFL** into their courses, showing dedication to improving teaching methods. Through the teamwork workshop, educators now see how self and peer assessment aids.	Positive views on using quizzes and data collection to inform teaching practices highlight a proactive approach to improving education.

Participants expressed cautious optimism, appreciation, gratitude, commitment to development, and support for data-driven initiatives, while also addressing teamwork conflicts. These sentiments highlight the value of a large-scale learning community that fosters cross-disciplinary idea sharing guided by the CDIO Standards. The ALC has provided academics with opportunities to strengthen and apply new knowledge to their teaching practices.

The findings indicate that while challenges persist, there is a solid foundation for continued growth in teaching practices through large-scale learning communities. The importance of contextualizing pedagogical initiatives to align with faculty values and beliefs is crucial. Institutions should prioritize creating learning communities that help faculty connect new teaching approaches with their personal goals. The general sentiment is that the CDIO approach may need to be more relevant to specific courses. To increase its adoption, future symposiums should focus on helping faculty contextualize CDIO in their pedagogy, enhance motivation to experiment with new ideas using templates, and encourage sharing both successes and challenges to demonstrate that failures lead to future success.

Limitations

This study has several limitations that affect the reliability and validity of the findings. The small sample size may limit the diversity of perspectives on the impact of ALCs on faculty. While the

varied roles and experiences of participants added richness, the results may need to be more generalized to other educational contexts due to factors like organizational culture and departmental priorities. The exclusive use of qualitative analysis may have restricted the breadth of data, with some participants deterred from fully reflecting. Future symposiums should encourage more detailed responses, and future research should include both qualitative and quantitative methods to provide a more comprehensive understanding of the impact. Promoting a culture of collegiality and shared learning among faculty is essential for improving teaching quality and professional growth.

CONCLUSION

This study explores the potential of a large-scale faculty LC symposium between two schools with different disciplines and pedagogies, viewing their diversity as an opportunity for cross-pollination. It aligns with CDIO standards 8 and 10, particularly in enhancing teaching competence. The positive faculty responses suggest a path for future joint CDIO-focused events. Key findings from participant reflections highlight themes such as Pedagogy and Student Quality, Teaching Process and Practices, and Feasibility. The faculty expressed cautious optimism, commitment to improvement, and support for data-driven approaches, underscoring the importance of CDIO-driven symposiums for fostering faculty development and pedagogical innovation.

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BIOGRAPHICAL INFORMATION

Geok Ling Soo-Ng holds a B.Eng. (Civil) and a Master of Technology in Knowledge Engineering. She is a senior lecturer and senior manager of T&L in the School of Architecture and the Built Environment at Singapore Polytechnic. With a strong passion for teaching and technology, she is committed to education through improving students' self-directed learning skills and mentor teaching staff through effective professional development, notably through the Faculty Learning Community (FLC).

Zhengping Liow is a lecturer in Architecture at Singapore Polytechnic and is completing his Ph.D. at the National University of Singapore. His research focuses on the intersection of educational psychology, design studio pedagogy, and cross-pollinative team learning strategies, specifically on the effects of power dynamics/structures inherent through the hidden curriculum of socialised design studios.

Corresponding author

Geok Ling Soo-Ng
Singapore Polytechnic
School of Civil Engineering and the Built Environment
500, Dover Road
Singapore 139651
ngl@sp.edu.sg