

STUDENTS' VIEWS OF SELF-REGULATED LEARNING STRATEGIES IN A BLENDED MODULE

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ABSTRACT

This paper seeks to contribute insights from an inquiry into how some students at Singapore Polytechnic (SP) viewed Self-Regulated Learning (SRL) strategies in a blended professional communication skills module in relation to their ability to manage their learning and self-development. SRL strategies may serve as drivers of students' ability to participate and develop in self-directed learning, and our findings indicated that respondents had positive beliefs about their value. However, these beliefs were rooted within conditions relating to the perceived practical value of the strategies for the given context and application, fit with personality, and ease-of-use, which informed or influenced students' choices of learning strategy. Although this paper did not originate within a CDIO context, and is not specific to engineering students per se, engineering students were among the multi-disciplinary mix of respondents in the study, and we find that our insights may hold relevance for CDIO Standard 2 learning outcomes, as presented in CDIO Syllabus v2.0 (Crawley, Malmqvist, Lucas & Brodeur, 2011) in terms of topic 2.4 (Attitudes, Thought and Learning), specifically 2.4.2 (Perseverance, Urgency and Will to Deliver, Resourcefulness and Flexibility), 2.4.5 (Self-awareness, Metacognition and Knowledge Integration), 2.4.6 (Lifelong Learning and Educating), and 2.4.7 (Time and Resource Management). The insights may inspire us to give attention to how our students think and operate, help us reflect on the roles we play as educators, and offer some ideas as to the learning designs we might consider as well as other on-the-ground work that we need to do to support our students' cultivation of self-regulatedness, self-directedness and life-long learning.

KEYWORDS

Learning Behaviour, Learning Strategies, Self-Directed Learning, Self-Regulated Learning, Self-Regulated Learning Strategies, Standards: 2

INTRODUCTION

Singapore Polytechnic's School of Life Skills and Communication offers professional communication modules that support the holistic development of students across the institution, including those in our Engineering courses. The curriculum is blended to give students greater flexibility and control over their time and pace of learning, while encouraging self-directed and lifelong learning habits.

With less instructor supervision in blended learning, students must be more self-reliant and self-regulated to be effective in their learning (Broadbent, 2017; Broadbent & Poon, 2015; Kizilcec, Perez-Sanagustin & Maldonado, 2017; Pardo, Han & Ellis, 2016; You, 2016). Consistent with the literature, we observed that some of our students respond well while others flounder at managing their time and tasks, producing lower quality work and missing deadlines, or giving up altogether when they encounter difficulties with learning material (You, 2016).

To improve our ability to support our students' management of learning, we conducted an inquiry based on the introduction of nine Self-regulated Learning (SRL) strategies (Broadbent & Poon, 2015) in our Communication for Professional Effectiveness (CPF) module, which equips students with resume-writing and job-interview skills, and workplace etiquette.

We gained interesting insights into students' perceptions of SRL strategies, which we offer in this paper, together with ideas for addressing them, as a contribution to discussions of how to scaffold and support students' development of CDIO Standard 2 competencies, particularly:

- 2.4.2 Perseverance, Urgency and Will to Deliver, Resourcefulness and Flexibility
- 2.4.5 Self-Awareness, Metacognition and Knowledge Integration
- 2.4.6 Lifelong Learning and Educating
- 2.4.7 Time and Resource Management

LITERATURE REVIEW

The Relevance of Self-Regulated Learning (SRL)

SRL is noted in education research for being essential to students' successful completion of their studies in higher education, and increasingly so in blended or online contexts (Broadbent, 2017; Broadbent & Poon, 2015; Kizilcec et al., 2017; Pardo et al., 2016; You, 2016). Of particular importance is the 'self-generated ability to control, manage, and plan their learning actions' (Ally, 2004, as cited in Broadbent & Poon, 2015, p.2), which requires the learner to 'be motivated, meta-cognitively involved, and an active agent in his or her own learning process' (Zimmerman, 1986, as cited in Broadbent, 2017, p.24), and to be competent in 'actively setting learning goals, employing effective and efficient learning strategies, making appropriate learning plans, adapting their approach from task to task, monitoring their learning persistently, and making adjustments when needed' (Pardo et al., 2016, p.423).

Unfortunately, many learners are unable 'to maintain their motivation and persistence' and 'are characterized by their failures in estimating the amount of time and effort required to complete tasks and their lack of time-management and life-coping skills' (You & Kang, 2014, Yukselfurk & Bulut, 2007, as cited in You, 2016, p.23-24). This signals that we cannot assume all students come readily prepared for learning, and that they must be equipped with 'coping skills'.

It is also notable that 'SRL behaviours are not a static trait of students per se' and 'students may change their motivation and SRL behaviour and strategy depending on the nature of the course, its structure and the proposed learning activities' (Pardo et al., 2016, p.423). This fluidity or complexity holds implications for how we interpret and act on students' learning behaviours as we must be mindful of the context and be flexible in responding to students.

SRL in Engineering Education

SRL has similarly been spot-lit in engineering education research. Nelson, Shell, Husman, Fishman and Soh (2015) argue that, 'Engineering, like all disciplines, requires students to engage in self-regulated learning inside (e.g., note taking, question asking) and outside of the classroom (e.g., studying), and requires students to persist, even in the face of failure' (p76), while Cervin-Ellqvist, Larsson, Adawi, Stöhr and Negretti (2020) point out that 'the importance of developing effective SRL strategies is particularly evident for engineering students, who face a fast-changing work life with increasingly complex challenges' (Hadgraft & Kolmos, 2020, Wallin & Adawi 2018, Zheng et al. 2020, as cited in Cervin-Ellqvist et al., 2020).

It has also been noted that cultivating SRL in students is not a straightforward matter. Nelson et al. (2015) highlight that 'consideration of multiple aspects of students' motivation and their approach to learning is especially important for engineering education research', as 'students' beliefs, perceptions, behaviours, and strategic approaches interact and affect each other' (p.92). Cervin-Ellqvist et al. (2020) echo these sentiments, noting that 'students' use of strategies has been shown to vary in response to their context of learning' and that 'strategies vary in effectiveness depending on materials, subject and the learners themselves... Clearly, there is some ambiguity about what students actually do when they use a certain strategy and why they use it, i.e. whether they use it because they (accurately or not) find it effective'.

The above arguments both invite and justify a closer scrutiny of how students understand and practise SRL and its strategies so that we can better support their efforts. To this end, we hope that insights from our inquiry may offer some clues to the student perspective.

SRL Can and Needs to be Developed in Students

Sharp and Sharp (2016) assert that 'many learners arrive at the postsecondary level academically underprepared; thus, development of learners' self-regulatory capabilities is an important instructional component that leads to academic success' (Bail, Zhang & Tachiyama, 2008, Gorga Cukras, 2006, Hu & Driscoll, 2013, Langley & Bart, 2008, as cited in Sharp & Sharp, 2016, p.58). In engineering education, Cervin-Ellqvist et al. (2020) note that, '[SRL] learning strategies are seldom explicitly taught in HE' (Bjork et al., 2013, as cited in Cervin-Ellqvist et al., 2020). The good news is that 'SRL is not a fixed trait, but rather a skill that can be developed and honed through experience and practice applying SRL strategies' (Azevedo & Cromley, 2004, Schunk, 2005, Zimmerman, 2015, as cited in Kizilcec et al., 2017, p.19). Verma, Ahuja and Hermon (2018) conclude 'after reviewing all the models of SRL that a learner can be helped in self-regulation through the understanding of SRL mechanisms' (p.8), while Pardo et al. (2016) advocate that we 'instruct self-regulation directly so that students' awareness of self-regulated learning can be raised' (p.426).

These perspectives hold relevance for how we might scaffold and support our students' development of CDIO Standard 2 competencies, which relate to students' ability to evaluate, adjust and persist in their learning endeavours. We offer some suggestions of actions to consider in the Discussion section below.

SRL Strategies

There exists a substantial body of work constituting decades of research into SRL strategies (Panadero, 2017; Verma et al., 2018). We found Broadbent and Poon's (2015) meta-analysis, highlighting nine SRL strategies that correlate to 'academic achievement in online higher education environments' (p. 5), most relevant and practical for our context and purposes. The nine identified SRL strategies, as listed in Table 1 below, served as a resource for our students while allowing us to spotlight 'SRL strategies' and survey students on their perceptions.

Table 1. Nine SRL Strategies Correlating to Online Achievement (Broadbent & Poon, 2015)

SN	Strategy	Definition
1	Metacognition	'the awareness and control of mental thoughts'
2	Time Management	'the ability to plan study time and tasks'
3	Effort regulation	'the capacity to persist when confronted with academic challenges'
4	Peer learning	'collaborating with other learners in order to aid one's learning'
5	Elaboration	'the ability to use new and existing information with the aim of remembering the new material'
6	Rehearsal	'learning by repetition'
7	Organisation	'the ability to highlight main points during learning'
8	Critical thinking	'the ability to carefully examine learning material'
9	Help seeking	'obtaining assistance from instructors with the aim of overcoming academic challenges'

INQUIRY OVERVIEW

Our inquiry was carried out through:

1. An explicit introduction of SRL and a handout of '9 Self-regulated Learning Strategies' (accessible via <https://bit.ly/31QPpxV>) based on a synthesis of definitions and helpful SRL practices and behaviours described in Broadbent and Poon (2015) and Pintrich, Smith, Garcia and McKeachie (1991) administered during lessons in the second week of semester.
2. Two surveys administered at the start and at the end of the module respectively to obtain students' perspectives of SRL strategies, based on a convenience sample of 13 classes that included Aeronautical Engineering, Aerospace Electronics, and Electrical & Electronic Engineering students.
3. Data analysis, comprising the coding of verbatim text segments and descriptive statistics, based on 109 respondents who participated in both Surveys 1 and 2.

RESULTS AND OBSERVATIONS

Students' Perceptions of the Usefulness of SRL Strategies at the Start of the Module

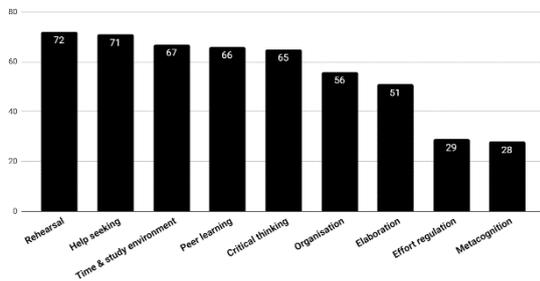


Figure 1a. Prevailing use of SRL strategies, ranked on number of responses.

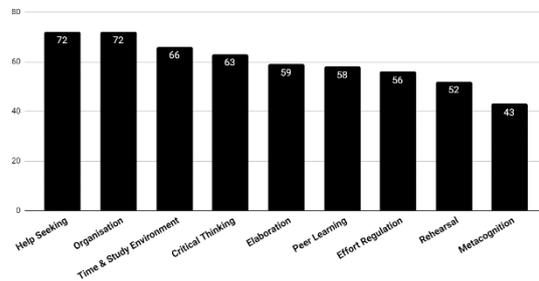


Figure 1b. SRL strategies respondents intended to use for CPF, ranked on number of responses.

Figures 1a and 1b feature the SRL strategies that respondents reported using prior to CPF, and those they intended to use for CPF. Their reasons revolved around the following themes:

1. Better management of self and tasks:
 - a. improved organisation and tracking of work leading to higher efficiency
 - b. better time management leading to less procrastination and less stress
 - c. correcting bad habits (procrastination) and building good ones (self-discipline)
2. Benefits for self-development in terms of:
 - a. monitoring and gauging one's performance
 - b. building resilience, e.g., by trying different approaches and persisting
 - c. holistic development, development as an independent learner, lifelong learning
3. Increased effectiveness and quality of learning in terms of:
 - a. better thinking, understanding and retention of learning
 - b. having greater control over learning, improved decision-making
 - c. increasing one's confidence and capability to handle novel situations
4. Familiarity and ease-of-use in terms of:
 - a. how 'intrinsic', 'natural' or 'automatic' the SRL strategies feel
5. Relevance to the context in terms of:
 - a. meeting the SDL approach and outcomes of CPF (interpersonal skills)
 - b. being most suitable 'for achieving successful and independent online learning'

From the above, we observed that respondents:

- seemed to hold largely positive beliefs of SRL strategies
- seemed to have an expectation that SRL strategies should be habitual
- believed the SRL strategies could benefit them in both the short and longer terms

Equally instructive were respondents' reasons for not using SRL strategies, namely:

1. 'Irrelevance', where SRL strategies were deemed:
 - a. not applicable or effective
 - b. not needed to do well
2. Unfamiliarity or difficulty with application where users:
 - a. do not know about them/do not know how to apply them

b. could not stick to them

The findings suggest that students' perceptions of the relevance, value and ease of use of SRL strategies are important factors that influence their choices.

Students' Knowledge and Use of SRL Strategies Reported at the End of the Module

Eighty-seven respondents (79.8%) reported that the knowledge or use of SRL strategies made a difference to the effectiveness of their learning in CPF, 16 (14.7%) were unsure, and 6 (5.5%) reported no difference.

SRL strategies appeared to enhance respondents' ability in five areas of self-regulation relating to perceived learning gaps in CPF (Figure 2).

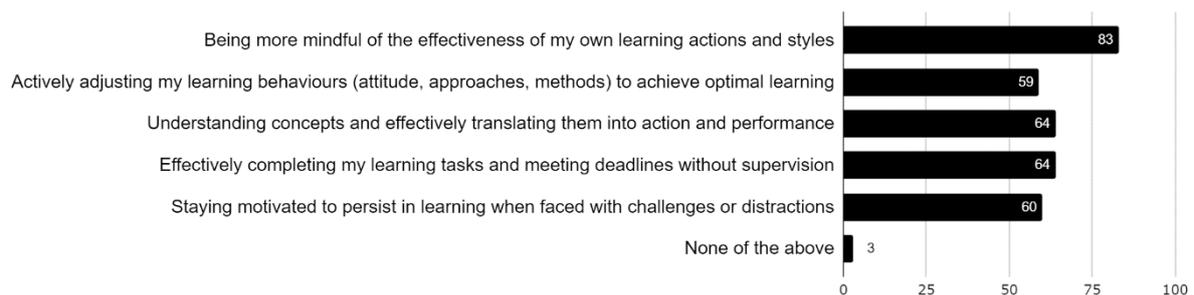


Figure 2. Perceptions of usefulness of SRL strategies in specific areas of self-regulation. Ninety respondents (82.6%) said they would continue using SRL strategies, 18 (16.5%) were unsure, and 1 (0.9%) said s/he would not continue.

Ninety-one respondents (83.5%) said that they would recommend the use of the SRL strategies to other students, 17 (15.6%) were unsure, and 1 (0.9%) said that s/he would not.

Positive Perceptions of SRL Strategies

Respondents who responded positively in the above areas indicated that SRL strategies:

- increased their efficiency and effectiveness in learning, made learning/studying easier
- improved their ability to manage time and keep up/stay on track with work
- helped to produce quality work, yielded positive results in performance
- gave them a sense of satisfaction
- would help not only in their current and future studies but also in work and life

Notably, respondents reported a heightened sense of self-efficacy in terms of:

- self-development/improvement, e.g., being more confident, motivated and adept at work, more independent, organised, adaptable, proactive, and able to self-regulate
- increased awareness of learning, learning new skills, e.g., changing their thinking, seeing things differently, widening their repertoire of assessment approaches

Those who indicated that they would recommend SRL strategies felt the strategies:

- are of a wide variety suitable for different personalities and work attitudes
- help struggling students as a solution to procrastination and frustration with learning
- are in line with lifelong learning

- are easy to pick up
- should be brought to the attention of more students

Reservations or Doubts about SRL Strategies

Respondents who indicated they were 'not sure' in the above areas said they:

- found it difficult to judge the effectiveness of the SRL strategies
- were uncertain about being able to 'keep it up' or continue applying them consistently
- were unsure if SRL strategies would be applicable in other/future contexts
- did not find the SRL strategies particularly helpful in CPF or applicable
- were considering using 'other strategies'

Those who were unsure of recommending SRL strategies felt that:

- SRL strategies do not suit everybody and that it depends on a student's personality and how compatible they are with SRL strategies
- it is difficult to apply SRL strategies constantly and consciously, or they are 'tedious'
- others may have better methods to help themselves

Those who indicated that SRL strategies did not make a difference or would not recommend them noted that they:

- did not perceive a difference
- were not yet convinced of the usefulness of SRL strategies
- 'stuck to old habits'

Equally instructive were respondents' reports on the SRL strategies that they would have liked to use but did not in the end (Figure 3).

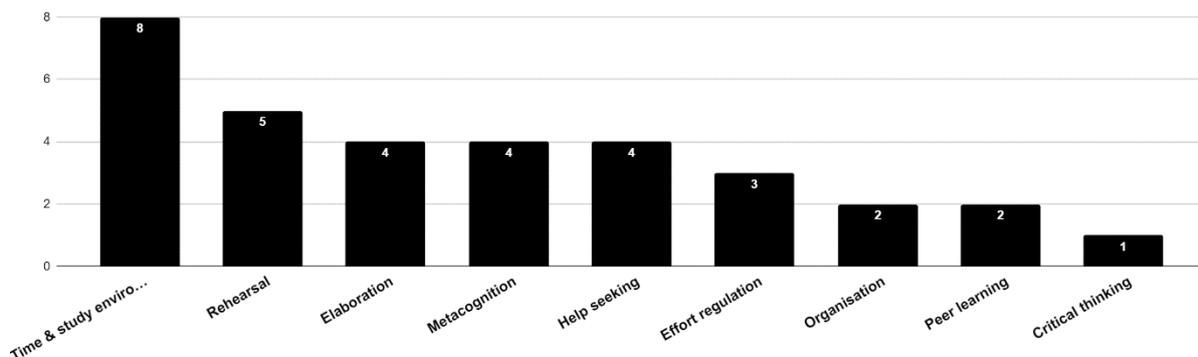


Figure 3. SRL Strategies that respondents did not use, ranked on number of responses

Respondents' reasons showed that they:

- were held back by lack of self-discipline, self-control or time
- had not yet mastered the strategy or made it a habit
- did not perceive a fit between SRL strategy and personality or learning style
- saw no relevance for application or did not have an opportunity to use an SRL strategy
- were frustrated by efforts, leading to failure to persist

A synthesis of the above themes and sentiments indicates that SRL strategies can benefit students in impactful, practical, even profound ways. However, users must deem them

relevant, effective, applicable and practical. Ease-of-use, 'compatibility' with 'personality', and the ability to persist seem to be important deciding factors in their adoption of SRL strategies.

LIMITATIONS

There are several limitations to our study. We did not use a validated instrument for our surveys and based our study on self-reported data, which may not 'properly represent actual self-regulated learning behaviours in authentic learning contexts' (You, 2016, p.23). Furthermore, we did not explore a more complex conception of SRL and how 'moderating factors work together with SRL strategies to influence academic achievement' (Broadbent & Poon, 2015, p.12), thus our interpretations are limited by our assumptions. Respondents' answers to our open-ended questions were at times brief or unclear, affecting our ability to completely or accurately interpret reasons or rationales. In addition, some students did not have a complete understanding of terminology, raising questions about the accuracy of their responses. Finally, we relied on a convenience sample that may not be generalizable to the population.

DISCUSSION

We drew two key lessons from our inquiry, and attempt to draw connections as well as suggest practical applications in synthesis with CDIO Standard 2 learning outcomes, specifically those under 2.4.2, 2.4.5, 2.4.6 and 2.4.7, in the discussion below.

SRL Strategies can Benefit Students in Impactful, Practical, even Profound Ways

Our findings indicate that introducing SRL strategies explicitly would make a difference to students' management of learning, as it makes visible to them some means of addressing their learning challenges and cultivating effective learning habits for lifelong learning. Our respondents signalled that they became more aware of how they manage themselves and their learning, with a majority reporting both short- and long-term benefits in:

- self-, time- and task-management,
- self-awareness, self-efficacy and self-development,
- effectiveness, quality, satisfaction and knowledge of learning

Some respondents were conscious of using the SRL strategies to adjust to a more independent way of learning, e.g., ‘It pushes me to do work consistently and have a self-check on where I am, hence being more independent with my own studies’, while others were able to leverage specific SRL strategies to their advantage, e.g., ‘I was able to apply [Time & Study Environment] in terms of planning ahead of time what are the tasks needed to do by looking at the module map.... Another example includes having set reminders either in my calendar or an app to remind myself of what I am required to do helps me manage my time more easily’.

These outcomes embody many of the desired traits outlined in CDIO Standard 2, which include such competencies as responsibility and determination to accomplish objectives, adaptability, skills to assess and take action for self-improvement, habitual exercise of metacognition, and ability to manage resources for optimal learning (Crawley et al., 2011) – in essence, students becoming more empowered and self-directed as learners. This suggests that it would be profitable for us to provision students with relevant SRL strategies to support their development of said CDIO Standard 2 competencies, to which end we offer suggestions in Table 2 below.

A Complex Interplay of Factors Underlies Students’ Decisions to Use SRL Strategies

We must be cognizant, however, of the complex interplay of factors underlying students’ use of SRL strategies and this, in our opinion, is the more striking lesson. Extending views we noted earlier from Pardo et al. (2016), Nelson et al. (2018) and Cervin-Ellqvist et al. (2020) on the complexity of student learning behaviour, our findings suggest that SRL strategies can be impactful but must be deemed relevant, practical and effective in users’ contexts. They are contingent on whether the strategies ‘fit’ with personality or learning style, and there appears to be an implicit belief that SRL strategies should ‘come naturally’. Users may give up if they encounter difficulties in the mastery of a strategy or if ‘too much effort’ is required.

This points to rather intuitive decision-making processes on our students’ part. SRL strategies may serve as drivers of students’ ability to participate and develop in self-directed learning, however, they appear not to be just a means to an end, but an experience that learners choose to undergo as a discrete part of their lives, with any choice made intimately tied to their identity. It is part of their ‘way of being’ (Walther, Miller & Sochacka, 2017). This implies that knowledge of ‘what to do’ may not necessarily lead to application if a learner does not perceive a fit with his/her ‘self-concept’, and suggests that the design and execution of any instruction on SRL strategies must recognise students’ sense of ‘self’ and address students’ motivations and barriers as a context for the introduction and use of SRL strategies.

In practical terms, ‘teachers have to take learning context and other factors (e.g. all areas of Pintrich’s model of SRL) into consideration to develop suitable educational approaches to scaffold students’ learning effectively..., a scaffolding that is often very limited as teachers tend to focus on the course content’ (Dunlosky & Rawson, 2019, Moos & Ringdal 2012, as cited in Cervin-Ellqvist et al., 2020). Underscoring the important facilitative role of teachers, Van Laer & Elen (2017) note how ‘learning and performance are improved by facilitating learners’ use of adaptive self-regulatory learning strategies’ (p.1406-1407). This suggests that, in the midst of content instruction, we should also give attention to facilitating students’ evaluation of their learning gaps, mindfully coaching students to shift their perspectives when they are unable to adjust their learning behaviours or choices, suggesting more appropriate learning strategies

for the context, coaching them in the effective application of a strategy, and giving opportunities for practice and recording results so that students may receive feedback that allows them to continue improving their attitudes, approaches and processes for learning. We outline some of these ideas in explicit relation to CDIO Standard 2 competencies in Table 2 below.

Table 2. Ideas to Support Students' Growth in CDIO Standard 2 Competencies

CDIO Standard 2 outcomes (refer to Crawley et al., 2011 for full list)	SRL strategies that may help	Practical steps for teachers
2.4.2 Perseverance, Urgency and Will to Deliver, Resourcefulness and Flexibility	Awareness of strategies like 'Effort Regulation' can help learners consciously increase their 'determination to accomplish objectives'.	Encourage and coach students to recognise their personal barriers to perseverance, regulate themselves and exercise flexibility in their learning approaches.
2.4.5 Self-Awareness, Metacognition and Knowledge Integration	Knowledge and use of 'Metacognitive Self-regulation', 'Elaboration' and 'Organisation' can help learners find ways to be more self-efficacious at 'overcoming important weaknesses,' and to 'link knowledge together and identify the structure of knowledge'.	Provide guided examples and exercises for practising 'Metacognitive Self-regulation'; facilitate the construction of new knowledge by coaching students to actively use strategies like 'Elaboration' and 'Organisation' within your specific lesson context.
2.4.6 Lifelong Learning and Educating	Making the wide range of learning strategies visible to learners should help them become more aware of their own learning style, recognize that choices are available, and begin to develop a repertoire of 'skills for self-education'.	Help learners diagnose their learning gaps, remind them that it is important to develop a repertoire of 'skills for self-education', and offer suggestions to aid the expansion of such knowledge.
2.4.7 Time and Resource Management	Strategies and steps for 'Organisation' of content for learning and mindfully adjusting or controlling 'Time and Study Environment' should provide ideas for learners to prioritise and fulfil tasks.	Make reminders and suggest tools (e.g., use of calendars and alerts, productivity apps) for students to organise and manage their 'Time and Study Environment' effectively for a given context.

CONCLUSION

This paper has attempted to contribute discussion points for the development of engineering students' Personal and Professional Skills and Attributes, with specific focus on learning outcomes under CDIO Standard 2 Topic 2.4 Attitudes, Thought and Learning (Crawley et al., 2011), through the lens of SRL and its strategies. While our initial intention was to 'contribute', in the end it is we who have gained valuable learning and a major insight for ourselves: it is the realisation that the learning outcomes specified in CDIO Standard 2 are not just 'desired outcomes' but the very foundations on which learners may thrive in their learning, that is, the ability to wisely make judgements about themselves, to have the means to make suitable adjustments, and the drive to be life-long learners. We believe these foundations must be deliberately integrated and explicitly built with a keen understanding of the way learners perceive themselves and their learning choices, accompanied by an appropriate provision of resources, such as relevant SRL strategies, and coaching to allow learners to evaluate

themselves and their learning choices. Therein lies our challenge as educators, but if we are able to do this well, the value to our learners could be immense, not only in their studies, but for life.

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BIOGRAPHICAL INFORMATION

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