# ENHANCING STUDENT ENGAGEMENT IN FLIPPED CLASSROOM USING AUTONOMY-SUPPORTIVE TEACHING

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## ABSTRACT

An education research project funded by the Singapore Ministry of Education Tertiary Education Fund entitled Enhancing Students' Intrinsic Motivation: An Evidence-based Approach was recently undertaken by the second author, who is also the Principal Investigator; and a group of lecturers including the first author. The broad research questions focused on how students experience their learning when teachers use an Autonomy-supportive Style of teaching and employ Evidence-Based Practices and Principles in their teaching approach. A significant aim is to identify specific evidence-based strategies to enhance students' active participation (agentic engagement) in both pre-class and in-class activities. This paper shares the results of the project by the first author in using autonomy supporting style of teaching to engage students in flipped classroom learning. The study used a mixed methods approach which includes survey questionnaire and focus group discussion of students, and lesson observation of the lecturers, as well as reflection journals by the lecturers. The result of this study showed that both an autonomy-supportive style of teaching and cognitive scientific principles of learning employed by the first author had positively impacted student engagement and self-efficacy. The qualitative data was particularly revealing in terms of how students experience their teachers in terms of the range of instructional and teacher behaviours that are most impactful. Outcomes from the rest of the research team, which cut across a range of disciplines and in different contexts, show similar findings. As such, a compelling case can be made for utilizing the approach employed and the area is rich for further research to delineate more specific aspects of practices that can positively enhance the subjective experience of students' learning in the context of intrinsic motivation.

## KEYWORDS

Autonomy supporting, cognitive scientific principles, student engagement, Standards: 10

NOTE: Singapore Polytechnic uses the word "courses" to describe its education "programs". A "course" in the Diploma in Chemical Engineering consists of many subjects that are termed "modules"; which in the universities contexts are often called "courses". A teaching academic is known as a "lecturer", which is often referred to as A "faculty" in the universities.

## INTRODUCTION

This paper shares the experience of the first author in executing an education research project in Singapore Polytechnic. The project is entitled Enhancing Students' Intrinsic Motivation: An Evidence-based Approach, and is supported by the Singapore Ministry of Education Tertiary Education Fund. The second author is the Principal Investigator. The first author, who teaches the Diploma in Chemical Engineering (DCHE) from the School of Chemical and Life Sciences, along with 6 other colleagues from various other Schools, took part in the project.

The project involves the lecturers systematically applying Evidence-Based Teaching (EBT) methods and learning principles (e.g. Hattie, 2009; Petty, 2009; Willingham, 2009; Sale, 2015) and autonomy-supportive teaching (e.g. Williams & Deci, 1996; Reeve, 2015) in their respective teaching discipline to the design and facilitation of classroom learning. EBT has evolved from a synthesis of research on what teaching methods work best and the increasing knowledge bases on how humans learn from the fields of cognitive science and neuropsychology. Autonomy-supportive teaching incorporates specific validated practices derived from Self-Determination Theory (e.g. Ryan & Deci, 2017).

There are 7 cohorts of students from different disciplines involved, over a period of one semester of study (15 weeks). The first author applied EBT and autonomy-supportive teaching to a total of 37 students in 2 classes from DCHE, in the Year 2 module entitled *Plant Safety and Loss Prevention*. The module is one of the core modules in DCHE, and is taught using the flipped classroom format. Work done by the 2 authors in flipped classroom are discussed elsewhere (Cheah, Sale & Lee, 2016; Cheah & Sale, 2017).


## CHALLENGE OF FLIPPED CLASSROOM: PRE-CLASS LESSONS

It is clear from the literature that flipped classroom, just like other forms of active learning, requires engaged students (Pienta, 2016), especially in going through the pre-class materials on their own before coming to class. However, not all students are motivated to put in the required effort to do so. Motivation and engagement are important drivers of deep learning (Kuh, 2003). But these students lack "homework culture" (Straw et al., 2015) and may come to class unprepared to participate in class activities.

Engagement is an important factor impacting learning: if students perceived that a learning experience was of value to their learning, they were more likely to use it (von Konsky et al., 2009). Murray, et al. (2012) suggested that students selectively access course content based upon the degree to which they perceive it will positively influence performance and outcomes on assignments and assessments. Due to time constraints, students tend to employ strategies that they perceive will provide an optimal outcome (Murray et al., 2013). The challenge for educators, especially those embarking on flipped classroom, is to design interesting pre-class online learning materials that students want to read up. Some authors recommended giving marks to students for completing their requisite pre-class readings, but this is not a position advocated by the first author. Instead, he seeks to motivate students by designing engaging pre-class learning tasks that are closely-coupled to what they will actually be doing in class. It is with this challenge that the first author embark on adopting the autonomy-supportive style of teaching to engage students in learning.


## INTRINSIC MOTIVATION AND AUTONOMY-SUPPORTIVE STYLE OF TEACHING

Self-Determination Theory (SDT) of motivation distinguishes between intrinsic and extrinsic motivations (Ryan & Deci, 2000). Intrinsic motivation refers to learning situations when one engages in the learning experience out of genuine interest for that topic or specific activity. Intrinsic motivation is the desired type of motivation for study as it is associated with deep

learning, better performance and positive well-being in comparison to extrinsic motivation (Kusurkar et al., 2011). It is dependent on the fulfilment of three basic psychological needs described by SDT: needs for autonomy, competence and relatedness. Autonomy-supportive teaching proposes to satisfy these needs in order to stimulate intrinsic or self-determined motivation among students as opposed to controlling teaching behaviour. Autonomy-supportive teaching makes students feel autonomous and competent in their learning and also supported by their teachers, fostering relatedness (Reeve, Deci & Ryan, 2004).

Reeve (2016) framed supportive autonomy being (a) the interpersonal effort to provide a *teacher-student relationship* and a *classroom environment* that appreciates and supports students' need for autonomy, and (b) an interpersonal tone of understanding that is highly respectful of the student's perspective and initiatives and implicitly communicates, "I am your ally; I am here to support you and your strivings". Autonomy-supportive teachers showed a distinctive motivating style as measured by their conversational behaviors, interpersonal style, and attempts to support students' intrinsic motivational and internalization processes (Reeve, Bolt & Cai, 1999). In concrete terms, the autonomy-supportive style is operationalized through behaviors such as (a) nurturing inner motivational sources, (b) providing explanatory rationales, (c) relying on non-controlling and informational language, (d) displaying patience, and (e) acknowledging and accepting expressions of negative affect. (Amoura et al., 2015; Reeve, 2009)

**Motivation and Engagement**

The distinction between these two constructs is that motivation is a private, unobservable psychological, neural, and biological process that serves as an antecedent cause to the publically observable behaviour that is engagement (Reeve, 2012). While motivation and engagement are inherently linked (each influences the other), those who study motivation are interested in engagement mostly as an outcome of motivational processes, whereas those who study engagement are interested mostly in motivation as a source of engagement. So, motivation is the relatively more private, subjectively experienced cause, while engagement is the relatively more public, objectively observed effect.

Four interrelated aspects of students' engagement during a learning activity are: behavioural engagement, emotional engagement, cognitive engagement and agentic engagement (Reeve, 2012). Making a judgment of how actively involved the student was in the learning activity would involve assessments of one's concentration, attention, and effort (behavioural engagement), the presence of task-facilitating emotions such as interest and the absence of task-withdrawing emotions such as distress (emotional engagement), usage of sophisticated rather than superficial learning strategies (cognitive engagement), and the extent to which one tries to enrich the learning experience rather than just passively receive it as a given (agentic engagement, see Reeve & Tseng, 2011; Reeve, 2013).

**DESCRIPTION OF WORK DONE**

The study involves a series of 7 cases; each case constituting the experiences of a lecturer and his/her students over a 15-week module. It also embodies an action research focus, e.g., understanding practice, how it is experienced by learners, and with a view to enhancing the learning experience for students (e.g. attainment opportunities; intrinsic motivation) and faculty competence in being able to do this better. The use of Petty's framing of 'Supportive Experiments' (Petty, 2015) provided the guiding heuristics for this action research focus. Essentially, this involves the teacher using a strategy (i.e. EBT, autonomy-supportive teaching) for a given period of time in order to adapt it where necessary to the student group(s) and develop the necessary skill to use it effectively and fluently.

### Broad Research Questions

The broad research questions focused on how students experience their learning when teachers use an Autonomy Supporting Style of teaching (Reeve, 2015) and employ Evidence-Based Practices and Principles in their teaching approach (e.g. Sale, 2015; Petty, 2009, Hattie 2009). They are:
- How do students experience their learning when teachers use an Autonomy Supporting Style and employ Evidence-Based Practices and Principles in their teaching approach?
- What are the key aspects of a teacher's instructional approach that most impact student's intrinsic motivation (e.g., engagement; self-efficacy); in what ways and how?

### Research Methodology

The study used a mixed methods approach (Grbich, 2013), summarized below:
- Quantitative data was collected through a pre- and post-intervention questionnaire incorporating items relating to supportive autonomy style of teaching, Cognitive Scientific Principles, Engagement Dimensions (i.e. behavourial, emotional, cognitive and agentic) and Self-Efficacy.
- Qualitative data focused on a more in-depth understanding of the students learning experience and was largely derived from collaboration with students from the class, who acted as co-participants (volunteers who were interested in the research projects and were prepared to have dialogue sessions regularly with the research team). Focus Group interviews with a larger student cohort and lesson observations by the Chief Investigator were also employed.
- Qualitative data from the first author's use of Evidence-Base Reflective Practice, a tool designed by the second author (Sale, 2015).

*The Questionnaire*

There are 3 questionnaires used in the process, which were synthesized from the works in the following areas:
- Student Engagement (Jang, Kim & Reeve, 2016)
- Autonomy Supporting Style (Williams & Deci, 1996)
- Self-Efficacy Scale (Bandura, 2006)
- Core Principles of Learning (Sale, 2015)

Questionnaires were administered before and after the implementation (week 2 and week 8 or 9) by the second author. The aim was to capture student's perceptions in the early part of their experience with the lecturer and then again after a substantive period of exposure. This enabled the identification of changes in perception over time, which could then be triangulated with the qualitative data.

*The Student Co-participants*

The student "co-participants" – a term used by Lincoln (1990), referring to students who take an active and interested participation in the research process and its aim – were an essential part of the research approach, as a main focus was on understanding how they experience and make meaning of their learning and teachers over time. All co-participants were volunteers and each class had a minimum of two. They were given a full briefing by the second author on the research purpose and their role and responsibilities in participating. It was made very clear that they should only participate if they felt that they could meet the responsibilities in an authentic and conscientious manner. They were specifically required to:
- Chat to classmates and identify their experiences of being in that class - what were positive and less positive experiences for them and what makes this so

- Meet with the researchers at least twice during the semester for group sharing
- Communicate on an ongoing basis with the research assistant who had set up WhatsApp groups with each class group of co-participants

*The Focus Groups*

The use of focus groups was employed for the following main reasons:
- Enables the collection of data relatively quickly from a larger number (as compared to individual interviews) of research participants
- Provides a more naturalistic context than the individual interview in that it is closer to the everyday conversations that people typically participate in
- Offers the potential of a synergistic effect in that it allows participants to react to and build upon the responses of other group members, producing richer accounts of the experience being investigated

The focus group interviews typically lasted around hour for each class in the project; the attendees included both the co-participants for that class as well as at least 6 other class members. The aim was to add further dialogue on what had been conveyed over time by the co-participants and other perceptions that may further enhance "theoretical saturation" (e.g. Glaser and Strauss, 1976) of the data to date.

*Evidence-Based Reflective Practice*

Reflective Practice (e.g. Schön, 1983; 1987) is not a new approach to improving teacher-effectiveness. The first author made 3 submissions of his reflections to the second author over the duration of the research. In this work, we strived to avoid the common pitfall articulated by Hattie (2009):

> *The current penchant for "reflective teaching" too often ignores that such reflection needs to be based on evidence and not post-hoc justification.* (p.241)

Hence, in this research the aim was to avoid such failings. Given the approach was to ascertain the impact of teaching approaches on the student learning experience that have been extensively validated, it seemed pertinent to use these same practices as the key constructs on which to conduct ongoing reflective practice. In this way the teacher-researchers could both plan their lessons with a high *predictive* capability of effectiveness, as well as use an evidence-based framework in the *diagnosis* of their lessons, post enactment. As this was an iterative process throughout the 15-week programme duration, we can make the case for it not being just "post-hoc justification".

*Lesson Observation*

Lesson observations were conducted by the second author and his research assistant for each class on at least one occasion. This was used to provide feedback across the research team and added a further dimension to the overall methodology. Observations confirmed the approaches taken, and students showed good attention and engagement. However, it was not viable, in terms of resourcing, to do multiple observations with different observers; hence, such inferences and interpretations are situated to this context.


**KEY FINDINGS**

In the context of this paper format, only a summary of the range of findings from the research is presented here. Also, these findings are pertinent to the first author's teaching, not the wider research team. Suffice to note that surveys were administered to all 7 groups of students, and at this time of writing, no separate individual results are available for each of the participating

lecturers. However, the quantitative data (see the section below) from student responses were found to be consistent across all 7 lecturers in their use of autonomy-supportive teaching and evidence-based practices and principles. This provided useful insight relating to the first research question:

- How do students experience their learning when teachers use an Autonomy Supporting Style and employ Evidence-Based Practices and Principles in their teaching approach?

Qualitative data from abovementioned sources were analysed by the second author and his assistant in order to answer the second research question:

- What are the key aspects of a teacher's instructional approach that most impact student's intrinsic motivation (e.g., engagement; self-efficacy); in what ways and how?

**Quantitative Data**

These were obtained from the pre-and post-questionnaires. The total responses for the 7 student groups were 216 for the pre-questionnaire, and 190 for the post-questionnaire. The quantitative data showed some significant positive differences in the students' experience of their learning from the initial to the post questionnaire administration. We were particularly interested in how the intervention impacted students' engagement, particularly Emotional Engagement and Agentic Engagement, as these contained items related to intrinsic motivation and our interest in encouraging students to be less reticent in class. The results were summarised below. A more extensive structural analysis of the data is presently in progress and will be presented at future conferences.

*Cognitive Scientific Principles (Core Principles of Learning, or CP in short)*

The overall impacts of the cognitive scientific principles were highly significant, Cohen's $d = 0.27$ & $p < 0.01$. Out of the 10 core principles, 5 were statistically significant using paired t-Test, as shown in Table 1.

Table 1. Quantitative findings for impactful core principles of learning

| | | |
|---|---|---|
| CP3: My teacher uses methods/activities that help us to understand the important concepts for this class. | Cohen's $d = 0.19$ | $p = 0.04$ |
| CP4: My teacher encourages us to think about what we are learning so that we can develop a good understanding of the topic areas. | Cohen's $d = 0.20$ | $p = 0.03$ |
| CP5: My teacher uses a variety of teaching methods and media that make the learning/lessons more interesting for us. | Cohen's $d = 0.40$ | $p < 0.01$ |
| CP7: My teacher provides us with useful practice activities to develop the skills we are learning. | Cohen's $d = 0.23$ | $p = 0.03$ |
| CP8: My teacher provides helpful feedback to help us develop and manage our learning effectively | Cohen's $d = 0.28$ | $p < 0.01$ |

*Engagement, Self Efficacy & Autonomy Supported Style*

Overall increase in engagement was significant, Cohen's $d = 0.21$ & $p = 0.03$. The increase in emotional engagement was significant, Cohen's $d = 0.19$ & $p = 0.05$. Similarly, the agentic engagement's increase was significant, Cohen's $d = 0.24$ & $p = 0.02$. Likewise, a significant increase was shown for autonomy-supportive teaching Cohen's $d = 0.33$ & $p < 0.01$ and self-efficacy Cohen's $d = 0.20$ & $p = 0.05$.

These results showed that both an autonomy-supportive style of teaching and cognitive scientific principles of learning employed by the first author had positively impacted student

engagement and self-efficacy. These results match the qualitative data in terms of how students experience their teachers in terms of the range of instructional and teacher behaviours that are most impactful.

### Qualitative Findings

Qualitative Data was collected from both students and lecturers involved; the former from student co-participants and focused group interviews; the latter from Evidence-Based Reflective Practice (Sale, 2015). There was also classroom observation by the Principal Investigator. The main qualitative data is in the form of transcripts from interviews with the student co-participants (41 in total), which provided the basis for understanding the experience of learning from a student's perspective. While focus groups were conducted for all 7 classes, they revealed little beyond what had been created through the interactions of the student co-participants and the researchers involved. We seemed to have attained, over the duration of the research some measure of 'theoretical saturation' (Glaser & Strauss, 1967).

The following are excerpts taken verbatim from notes of focus group discussions conducted by the second author and his research assistant. There were 4 focus group discussions conducted over the research period. The first author is not present in all these discussions.

"*When asked if the class felt comfortable with the teacher, the students felt that they were. Across the whole class, students felt comfortable asking questions. Humor was also used in his lesson. One student commented that the atmosphere and relationship built was 'good for tertiary education'.*"

"*When asked if other teachers were like Sim (sic) Moh, it was agreed by the group that he was different. Unique meant 'better'. One student explained that Sin Moh encouraged the students to think instead of just 'copying the model answer'. The teacher always encouraged students to think of other alternative answers instead of just the most basic answer. The student felt that this method was very useful as it allowed them to understand better as it is not just memorization.*"

"*When asked if the teacher was sensitive to the students, one student commented that he was. The teacher was aware that the students were very lethargic and thus, he gave them an activity to wake them up. The teacher did not tell them off. When asked if they felt comfortable asking the teacher questions, the students said that the teacher was very open to their questions. When the students asked a question, the teacher would say 'what can I NOT do for you'. The students also felt that the teacher interacted with them, so they felt very comfortable around him. This led them to feel that the lesson was more enjoyable.*"

"*Students felt that although the module itself was boring, the lecturer was doing his best to make it fun. For example, the lecturer uses humor. One student said that the lecturer did bother to foster good relations with the students. For example, if a student came early, the teacher would engage in conversation with him.*"

"*When being asked whether they felt if they were able to ask questions and suggest ways of doing things, students felt that they had choices. E.g. how they learn the material for their own work like watching videos and case studies. Students liked the fact that they had choice on how they learn the content.*"

"*The students felt that the tasks they were given increased difficulty. Learning was challenging but achievable. They did not find the learning to be boring. Also, they felt that they had plenty of opportunities for feedback. E.g. Material was put up on Google docs and plenty of test opportunities on what was right and not right and what to do if they got the wrong answer.*"

"*An important thing which one student mentioned was that the teacher had a good balance of strictness and humor. They felt that the teacher was very serious about their learning but at the same time could have a bit of fun and balance that → students were comfortable and could have a laugh with the teacher.*"

## DISCUSSION ON WORK DONE

From these results, it can be seen that a lecturer using autonomy-supportive teaching is able to impact students' engagement in class despite teaching a module that is widely perceived as boring in nature. From the experience of the first author, using informational, non-threatening language certainly helps in quickly building rapport with the class. By acknowledging their negative feelings allows one to come across as sincere, and also permits the author to further engage students in diagnosing issues they faced, as well as possible ways of solving them. In fact, what the author observed is that, often, students themselves are aware of the underlying causes, and plausible solutions, and they readily acknowledged that what they lacked is the discipline to regulate their own learning process.

It is of interest to look at the general student feedback (SFB) on modules, an undertaking required by the institution once every academic year. Students need to answer 6 questions relating to the module. Figure 1 shows the SFB results for the module on 4 consecutive runs since teaching was undertaken by the first author back in April 2015, where flipped classroom is implemented. Run No.4 is the one whereby autonomy-supportive teaching is used by the first author. The SFB survey is based on a Likert Scale from "1" (for "Strongly Disagree") to "5" (for "Strongly Agree"). From Figure 1, it can be seen that students in Run 4 generally found the workload to be comparable with that in Run 3. However, there is a significant increase in their satisfaction with the way the module was taught and the quality of the module. What can be inferred from this is that while students still have strong negative feelings and lamented about flipped classroom, their engagement in this mode of learning nonetheless had increased. From the qualitative feedback, it appears that the students certainly had a sense of autonomy in their learning of the module, developed a feeling of relatedness, and attained a certain level of competency in handling safety issues in a chemical plant.
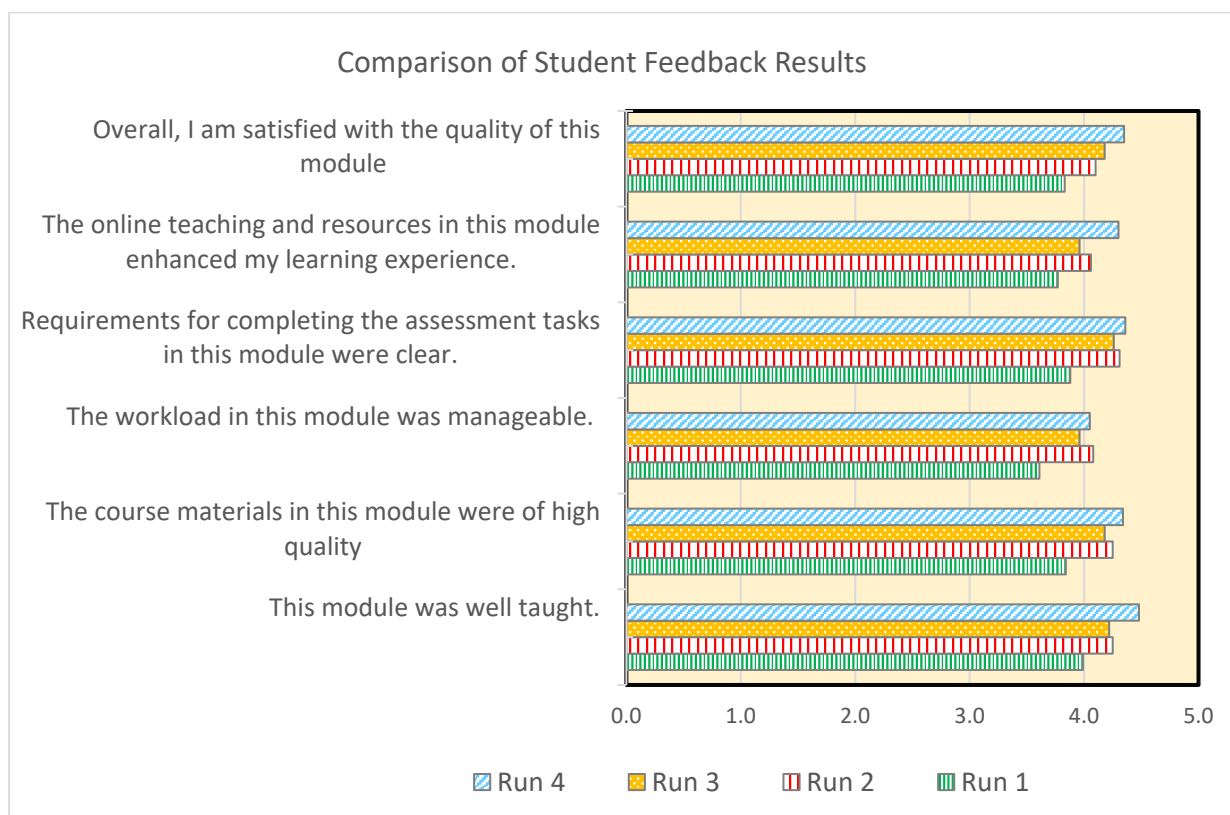


Figure 1. Comparison of student feedback for the module

It may also be useful to compare and contrast the findings from the first author's "experiment" with the other colleagues involved in this study, who may or may not employ a flipped classroom learning format. Also, extracting findings from student surveys that are specific to the first author's teaching of the module may enable more insight into student's engagement and self-efficacy in flipped learning.

Based on the results, it can also be suggested that it is the skilful use of the core principles of learning in the design of the learning materials, coupled with use of autonomy-supportive teaching that can turn subjects thought to be boring into more interesting learning experiences, regardless of the format that a subject is taught (flipped classroom or otherwise).


## POSSIBLE FUTURE WORK

Moving ahead, there are several opportunities for further research. One important area is the present SP institution-wide initiative to infuse self-directed learning into all curriculum in an effort to support a nation-wide SkillsFuture Initiative (Cheah et al., 2019). This will necessitate providing more regular feedback to students on their learning progress. Butler & Winne (1995) had earlier highlighted the importance and role of feedback in engagement and achievement. To be effective, feedback must be used by learners. Jonsson (2013) noted that students might not engage with their feedback for 5 reasons: (a) it may not be useful; (b) it may be insufficiently detailed or individualized; (c) it may be too authoritative in tone; (d) students may not know suitable implementation strategies; and (e) students may not understand the terminology used in feedback. Winstone et al. (2016) suggested the study of "proactive recipience" as a form of agentic engagement that involves the learner sharing responsibility for making feedback processes effective. Also looking at engagement from student's perspective, Reeve (2013) proposed an investigation into how agentically engaged students create motivationally supportive learning environments for themselves, and hence supporting self-regulated learning. Such self-regulation may come about when learners identify with the relevance of the learning task, via the process of internalization. Vansteenkiste et al. (2018) argued that the process can come about with autonomy-supportive teaching, especially the provision of a rationale. Such internalization, in addition to intrinsic motivation, constitutes a critical growth process within SDT.


## CONCLUSION

This paper presents a research project that employed an Evidence-Based Teaching approach, encompassing the systematic use of an Autonomy-Supportive Style of teaching for a flipped classroom module. The findings have been positive in terms of the ratings for the engagement items from the questionnaires employed. Of most interest is the data from the student co-participants as this catches their experiences over time and in their own words. While we can teach from good pedagogic intentions, it is how students actually make meaning of what we do from their perspective that counts in terms of their orientation to learning. The student response here suggests that the approach has resulted in good rapport and engagement with students, facilitating favourable outcomes both in terms of attainment opportunities and making the learning experience more engaging and fun. The development of agentic engagement is especially important, as it constitutes an essential component for developing the capability for self-determined lifelong learning.

This is especially important, particularly from the point of view of CDIO Standard 10, which emphasizes the continuing professional development of lecturers to teach and assess students in new ways (such as flipped classroom). Being able to identify with the students' needs is an important factor as lecturers moved from the traditional role of teaching of knowledge to facilitate student learning of such knowledge alongside key skills and attitudes. More significantly, students are more motivated in their learning and take positive steps in

constructively, contributing to his/her own learning. This can serve to retain student interest in learning engineering, which is one of the fundamental goals of the CDIO Initiative.

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