***From the Classroom to the Community and Back: The Development of a
Community-Based Research Model for Contemporary Higher Education***

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Abstract
Community-based research is a collaborative research approach to address a
community-identified need that can also be used as a pedagogical tool. In this study,
we describe the development of the Capstone experience module, an academic
module at a residential college in an Asian university. This module creates an unique
learning environment through the formation of a tripartite partnership among
undergraduates, educators and the community to collaboratively engage in research to
effect social change. Through the 'inward' constructive alignment of the assessments
to the module Intended Learning Outcomes (ILOs) and the 'upwards' mapping to the
broader educational aims (i.e. Programme ILOs and Association of American
Colleges and University Essential LOs), we were able to validate that this module fits
coherently with the broader curricular approach to scaffold the students' personal
development within the university. Through a hermeneutic analysis of the reflections
of students in their learning journals, we demonstrate that such an approach can
benefit the community partner and provide opportunities for the undergraduates'
development of critical competencies. These results accentuated how community-
based research projects hold significant pedagogical value for contemporary higher
education.

Keywords: Community development, research methods, experiential learning

Introduction

Community-based research (CBR) is a collaboration between educators, students and the community to address emerging needs through inquiry (Strand et al. 2003). With early engagement of the community throughout project planning and execution, this approach enables deeper understanding of the community to develop more effective research (Anderson 2002). The emphasis on sustained communication throughout the project also allows timely feedback on the research methods and promotes collective decision-making to build rapport (Anderson 2002).

CBR differs from typical research programmes in which researchers are more task-oriented and adopt an objective stance (Strand et al. 2003). In CBR, researchers engage diverse communities in identifying the problem and developing solutions (Padilla et al. 1999). Furthermore, CBR distinguishes itself from service learning where students learn through exposure to different life experiences and activities without conducting academic research (Anderson 2002). In contemporary higher education, CBR enhances practical and research skills (Margolis et al. 2000) to facilitate the transition of students to practitioners (Anderson 2002). The ability to meet the academic missions of teaching, research and service has made CBR a revolutionary pedagogical tool (Strand et al. 2003).

To date, CBR is widely employed for the social service sectors and clinical work where the focus is on service provision to improve the community's well being (Strand et al. 2003). However, the application of CBR beyond interdisciplinary settings is scant. In recent years, the emergence of interdisciplinary subjects has created possibilities for CBR to be applied to a broader range of topics. For instance, environmental science synergizes principles from biology, geography and sociology (Franks et al. 2007) and local communities are often involved in programme development and decision-making (Hindmarsh and Matthews 2008). Recognising the pedagogical value of CBR and the need to develop a CBR model for interdisciplinary classrooms, the Capstone experience (CAPSTONE) module was conceptualized to create this unique learning platform.

In this paper, we describe the underpinning curriculum framework for the CAPSTONE module offered by the College of Alice & Peter Tan (CAPT), a residential college in the National University of Singapore, and we demonstrate how the module learning outcomes are aligned to broader educational aims. To demonstrate the pedagogical value of this module in enhancing student learning, we drew upon evidence from a pilot study from which we conducted a hermeneutic analysis of the students' reflections documented in their learning journals.

Curriculum framework and module design

In our review of the literature, we were conscious of the need to find a higher education framework that facilitates student learning through research and yet, flexible enough to be applied across disciplines. Furthermore, the framework has to facilitate close collaboration among the college's academic staff, undergraduates and community partners, a prominent feature of CBR (Anderson 2002). Amidst the myriad frameworks available in the literature, the connected curriculum (Fung 2017) offered the closest alignment to what was required for the CAPSTONE module.

Fung (2017) listed the six dimensions of the connected curriculum as:

1. Students connect with researchers and the institution's research
2. A through line of research activity is built into the programme
3. Students make connections with subjects and out to the world
4. Students connect academic learning with skills for the workplace
5. Students learn to produce outputs – assessments directed at an audience
6. Students connect with each other, across phases and with alumni.

To situate the CAPSTONE module to the connected curriculum, the module was aligned to the connected curriculum framework through the module's design, supported by the formative assessments (Table 1). In the CAPSTONE module, three to five undergraduates work in a team to address a need identified by the community over the semester (13 weeks). Prior to the commencement of the module, each group is requested to submit a formal research proposal to outline the background of the issues they are addressing, aims, timeline, methodology for implementation and evaluation of their programme. The formal assessments for this credited module include: 1) situational analysis to link the scholarly underpinnings to the issues identified together with the partner, 2) a final presentation to the college's academic staff, undergraduates and community partners to share their work and findings, 3) a final report, 4) a peer and tutor review of the group members' performance and 5) a personal reflection of their learning points throughout the programme.

Dimension	CAPSTONE module design	Supporting assessments
1	Students work with academic staff and community partner to develop a project	Situational Analysis
2	Students conduct research or piloting an intervention on a topic identified by the community partner	Situational Analysis, final report
3	Academic staff provide guidance for students to relate issue to scholarship and broader discourse	Situational Analysis, final report
4	Community partner provide guidance for students to relate issue to practical application and constraints	Situational Analysis, final report
5	Students share their findings through a presentation with college staff, students and community partners.	Final presentation
6	Students work in groups of 3 to 5, of which up to 50% of the team can be college alumni	Reflection, peer review, tutor review

Table 1. The alignment of the CAPSTONE module design to each dimension of the connected curriculum framework and the supporting formal assessments.

Methods

Constructive alignment of the CAPSTONE module

To situate the CAPSTONE module within educational scholarship, we were guided by the four major steps highlighted by Biggs (n.d) to constructively align the module:

1. Defining the Intended Learning Outcomes (ILOs)
2. Choosing teaching/learning activities that lead to the ILOs
3. Assessing students' actual learning outcomes
4. Arriving at a final grade.

The module ILOs were developed based on the Structure of Observed Learning Outcomes (SOLO) taxonomy **(**Biggs & Collis, 1982) and subsequently aligned the assessments to the revised ILOs to identify key gaps in the module that can be supplemented by other teaching activities.

While this 'inward' constructive alignment was effective in mapping the teaching activities to the module ILOs, an 'upward' alignment was needed to help us understand the extent to which this module was in line with the broader educational aims (Figure 1). This alignment was done at two levels – the 17 proximal goals listed in the residential college programme ILOs and the 12 selected distal goals listed in the Association of American Colleges and University (AAC&U) Essential Learning Outcomes (ELOs). The latter was selected because of its focus on liberal education that resembled the approach used in the residential college programme and the scientific rigor that underpinned the development of the ELOs.
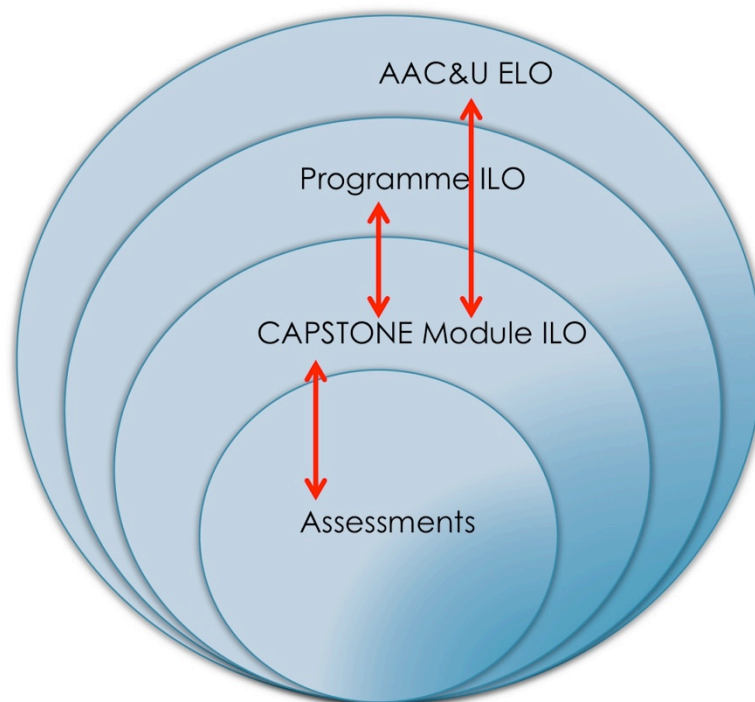

Figure 1. Approach to constructively align the CAPSTONE module.

Assessing the pedagogical value of the CAPSTONE module on undergraduate learning

To evaluate the pedagogical value of the CAPSTONE module, a pilot study was conducted in 2018 based on an environmental science education CBR project, done by a group of three undergraduates from different disciplines together with a local high school (see Toh and Tambyah 2018). A hermeneutic analysis of the

undergraduates' reflective journals, which were submitted as part of the module requirements, was coded against 12 selected AAC&U VALUE ELOs classified under four categories: 1) Integrative and applied learning, 2) practical skills, 3) personal and social responsibility and 4) intellectual skills. To triangulate the data collected, the supervisor's observation and reflection on undergraduates' progress throughout the CAPSTONE project was also recorded for each variable.

Results and discussion

Outcomes of the 'inward' and 'upward' alignment of the CAPSTONE module

The constructive alignment of the module began with development of the ILOs for the CAPTSTONE module, mapped to the SOLO taxonomy (Table 2). These ILOs were designed to scaffold learning and they included both cognitive (e.g. analyzing root causes) and practical skills (e.g. communication and teamwork).

ILO	Module ILOs	SOLO level
1	*Describe* the social, economic, cultural, historical and political context of the issue or question to be addressed within a defined community in Singapore or the region.	Multi structural
2	*Justify* the need to consider ethics, justice and equity in decision-making	Relational
3	*Analyze* needs and root causes pertinent to the issue or question, within an interdisciplinary framework	Relational
4	*Apply* sound and appropriate methods towards creating effective strategies to address the issue or question	Relational
5	*Apply* communication skills to effectively engage the stakeholders	Relational
6	*Reflect* on the impact of individuals, government, civic and private organizations on society, and the implications for policy making in the broader context	Extended abstract
7	*Build* cooperative relationships by accommodating different points of view and functioning effectively as a member of a team	Extended abstract

Table 2. Mapping of the module Intended Learning Outcomes (ILOs) to the Structure of Observed Learning Outcomes (SOLO) taxonomy.

The mapping of the original assessments to the revised module ILOs demonstrated that they were constructively aligned. Each ILO was adequately mapped to three assessments and thus no major changes were made (Table 3). To further enhance the learning value of the module, two teaching activities were introduced. Academic supervisors were encouraged to meet up with the students at different stages of the project so that there will be timely guidance on the academic and ethical contexts of the issues being addressed by the students, to support ILOs 1, 2, 3 and 4. In addition, it was suggested that the academic supervisors provide regular feedback on the undergraduates' performance and team dynamics collectively to support ILOs 5 and 7. More recently, a new research module was introduced in the college to equip students with community-based research skills. Hence, undergraduates who are enrolled in the CAPSTONE module were encouraged to attend selected classes in that module to build up the skills needed to support ILOs 4 and 5. Overall, this 'inward' alignment of

the module facilitated a clearer articulation of the module ILOs and enhanced the relevance of the teaching activities.

ILOs	Situational analysis	Final report	Final presentation	Peer review	Tutor review	Reflections
1	✓	✓	✓			
2	✓	✓	✓			
3	✓	✓	✓			
4		✓	✓		✓	
5				✓	✓	✓
6		✓	✓			✓
7				✓	✓	✓

Table 3. Constructive alignment of the assignments to the module Intended Learning Outcomes (ILOs)

The 'upward' alignment of the module ILOs to the residential college programme ILOs demonstrated the close alignment between the two (~90% alignment; Table 4). As the programme ILOs took reference from the AAC&U ELOs, the module ILOs and the AAC&U educational goals were also closely mapped (~87% alignment; Table 5). We are keenly aware that this is not indicative of the 'success' of this module nor will the module guarantee that the undergraduates achieve all the ILOs. Instead, this 'upward' alignment demonstrated that the module fits coherently with the broader curricular approach to scaffold the undergraduates' personal development in the university and it helps us identify possible areas for improvement. In this case, the close alignment highlighted that we should focus on helping the undergraduates achieve the module ILOs, rather than institute major changes in the CAPSTONE module's teaching and learning activities.

Programme ILO/Module ILOs	1	2	3	4	5	6	7
Critical Thinking							
Adopt a reasoned approach to analysing global and intercultural issues, taking into account multiple perspectives	✓	✓	✓	✓		✓	✓
Identify, access, organize and evaluate information, and apply appropriate frameworks to interpret data and knowledge, make inferences and evaluate arguments and claims	✓	✓	✓	✓	✓	✓	✓
Accept and manage ambiguity when faced with incomplete information and limitations	✓	✓	✓	✓	✓	✓	✓
Reflect on the assumptions and norms that shape one's own thinking, and be open to a change in perspective		✓	✓	✓	✓	✓	✓
Think divergently, and creatively formulate questions and ideas that promote innovative solutions to global and social issues			✓	✓	✓	✓	✓
Appreciation of Complexity							
Understand how human society is shaped by a complex	✓	✓	✓	✓		✓	✓

Programme ILO/Module ILOs	1	2	3	4	5	6	7
and diverse set of factors rooted in history, context, and culture							
Engage with contemporary and enduring issues, and the big questions of the day	✓	✓	✓	✓		✓	✓
Engage with multiple perspectives across academic disciplines and professional fields, and understand that many issues transcend particular disciplines	✓	✓	✓	✓	✓	✓	✓
Value diversity of identities, perspectives, opinions		✓	✓	✓	✓	✓	✓
Effective Communication							
Organize thoughts and arguments coherently and logically, in support of judgments, choices, claims or assertions	✓	✓	✓	✓	✓	✓	✓
Convey arguments and points of view, using both written and oral forms of communication, in a clear and effective way	✓	✓	✓	✓	✓	✓	✓
Collaborate with others who come from different backgrounds or hold opposing points of view, towards a common goal; work cooperatively in teams	✓	✓	✓	✓	✓	✓	✓
Practise self-awareness and empathy for other people's situations and contexts, and respect for others' arguments.		✓	✓	✓	✓	✓	✓
Personal and Social Responsibility							
Demonstrate understanding of local, regional and global issues using Singapore as a point of departure	✓	✓	✓	✓	✓	✓	✓
Practise ethical reasoning and action through active involvement with diverse communities and real world challenges		✓		✓	✓	✓	✓
Demonstrate intercultural knowledge and competence through the same		✓	✓	✓	✓	✓	✓
Establish foundations for lifelong learning, including formulating and prioritizing personal goals, managing time and resources, and learning from past actions			✓	✓	✓	✓	✓

Table 4. Constructive alignment of the module Intended Learning Outcomes (ILOs) to the residential college programme ILOs.

AAC&U essential learning outcomes/Module ILOs	1	2	3	4	5	6	7
Practical skills							
Communication	✔	✔	✔	✔	✔	✔	✔
Teamwork	✔	✔	✔	✔	✔	✔	✔
Problem solving				✔	✔	✔	✔
Intellectual skills							
Inquiry and analysis	✔	✔	✔	✔	✔	✔	✔
Critical thinking		✔	✔	✔	✔	✔	✔
Creative thinking			✔	✔	✔	✔	✔
Personal and Social Responsibility							
Civic engagement		✔	✔	✔	✔	✔	✔
Intercultural knowledge	✔	✔	✔	✔	✔	✔	✔
Ethical reasoning		✔	✔	✔	✔	✔	✔
Integrative and applied learning							
Foundations and skills for lifelong learning	✔	✔	✔	✔	✔	✔	✔
Global learning	✔	✔	✔	✔	✔	✔	✔
Integrative learning	✔	✔	✔	✔	✔	✔	✔

Table 5. Constructive alignment of the module Intended Learning Outcomes (ILOs) to the Association of American Colleges and University (AAC&U) Essential Learning Outcomes (ELOs).

Pedagogical value of CAPSTONE module – practical skills

Since the undergraduates belonged to different disciplines, the module created a platform to learn and appreciate different practical skills. In the supervisor's personal reflection, it was noted that,

> "*The evaluation of the programme outcome required a lot of collaboration, as the students needed to tap on each other's strengths (e.g., statistics, education and environmental science background) to develop a coherent report. The regular group discussions were important in helping them synergise their individual efforts". Supervisor's reflection*

For instance, the use of statistical tools in the data analysis was the strength of the Mathematics major and he taught the skills to the other team members. The undergraduates also highlighted the need to understand and *"build on each other's strengths in a team, and that a team is really more than a sum of its parts"* (Undergraduate 2) and unanimously acknowledged that teamwork was essential to meet the objectives.

As a result of the dynamic nature of the project, the undergraduates had to change their plans and to learn to focus on solving the issue. The supervisor noted that,

> *"The breakdown of the food digester was a huge surprise and the students had to quickly amend their proposal. This placed them under a lot of stress and I had to spend some time calming them down. Eventually, they revised the original content and I was surprised that they adapted so quickly to the changes." Supervisor's reflection*

Beyond developing the solutions, the undergraduates noted that it was equally important to learn how to manage their anxieties and emotions to respond to the problem, especially in light of the tight timelines. The undergraduates highlighted that,

> *"This helped me realise that when unforeseen issues occur, we need to remain calm and focus first on doing what necessary and possible, then worry about the other details later." Undergraduate 2*
> *"With much guidance and thorough discussions within the team, we were able to plan for the changes requested by the school." Undergraduate 1*

The undergraduates also appreciated the importance of communication as a practical skill to facilitate the delivery of knowledge and skills to the high school students. Peer learning was evident in the programme as the undergraduates were able to pick up communication skills from their team members. What was most significant was the realization that active communication with the partners throughout the engagement was essential in understanding each other's perspectives and to keep up-to-date with the changes in their plans. One undergraduate noted,

> *"I came to understand that when working with a community-based partner, communication between the parties and understanding the other party's perspective is crucial." Undergraduate 1*

This corroborated with the supervisor's observations that they were quick to *"set up various communication channels (e.g., informal meeting, whatsapp groups) to ensure that the goals were mutually aligned and the logistics were prepared prior to each lesson"* (Supervisor's reflection). The value of timely and constant communication was a clear learning point for the undergraduates.

Pedagogical value of CAPSTONE module – intellectual skills

While all the undergraduates had some exposure to environmental science through their formal curriculum in the university, the programme required a foundational understanding of pedagogical theories and methods, a discipline that the undergraduates were unfamiliar with. In this process of inquiry, the undergraduates found that consultation with the teaching staff and literature review were essential in structuring their lessons in the programme. They were able to *"understand more about pedagogy and ensure that helpful practices are adhered to"* (Undergraduate 2). The promotion of deeper and broader inquiry is likely a result of the interdisciplinary nature of the team facilitated through the CAPSTONE module that is enhanced by *"the element of peer learning evident in this project"* (Supervisor's reflection).

The objectives and the constraints imposed by the partner also necessitated the undergraduates *"to be creative and work around the constraints"* especially when *"multiple unexpected events and developments occurred"* (Undergraduate 2). Creative

thinking was demonstrated when the team created an evidenced-based game that served as a pedagogical tool to help the high school students appreciate complexity, when the duration for the class was abruptly reduced. The team also decided to incorporate a field trip to maximize learning for the high school students when they *"could have stuck with classroom sessions that was originally discussed"*

(Supervisor's reflection). Ultimately, the field trip to an eco-resort was rated the most effective component of the course and prompted deeper reflection among the participants. One undergraduate remarked,

> *"Based on the feedback received in the Focus Group Discussions, the students generally enjoyed the novel teaching methods we employed, including games and references to real-life examples. This made the additional effort and time put in to design effective lessons feel worth it." Undergraduate 2*

Furthermore, the process of reviewing the literature allowed them to critically examine what they initially thought was a *"convenient and efficient"* (Undergraduate 2) approach to delivering the content of the lessons in the programme and to discover the inadequacy of this approach with those suggested in the literature. The programme also prompted the undergraduates to challenge their preconceived notions of education and one of them remarked,

> *"I have always thought that education is power, but I learned that power does not always lead to change" Undergraduate 3*

From the supervisor's observations made during the students' debrief, he also noted,

> *"The initial literature review phase compelled the students to think deeply on how environmental education should be done and this academic grounding helped students constantly reflect and evaluate their assumptions and actions." Supervisor's reflection*

Pedagogical value of CAPSTONE module – personal and social responsibility

For the undergraduates, this project was their first attempt at engaging and mentoring younger students in a high school. The undergraduates noted they were *"nervous and unsure about how to approach, guide and mentor students of this age"* (Undergraduate 3). Through this process of civic engagement, the supervisor could see the undergraduates *"become more aware of their emotions in face of the uncertainty of their engagement and their attitudes towards the high school students"* (Supervisor's reflection). One undergraduate also expressed that she was conscious *"not to misunderstand [the high school students] or easily pass judgment, in order to have more meaningful interactions with this community"* (Undergraduate 3).

This in turn, facilitated the undergraduates' understanding of the challenges the high school students' faced, and the *"need to meet academic, co-curricular and personal expectations, coupled with peer and societal pressures"* (Undergraduate 3). The supervisor noted that *"the undergraduates were clearly more emphathic towards the high school students as the programme progressed and grew more conscious of their choice of words"* (Supervisor's reflection). They simplified the content to match the

aptitude and interest of the high school students and chose a non-directive approach that instils self-motivation. One undergraduate noted that,

> *"It is always crucial that we, as mentors, do not get too caught up in "preaching" but more so in guiding and truly understanding what resonates with and motivates the students"* Undergraduate 3

In addition, they highlighted the importance of protecting the identities of participants in research studies, and appreciated that these studies have to be done professionally and ethically to safeguard the interests of young children (7.3 ± 0.06, Table 7). One undergraduate noted,

> *"I was unmotivated to complete this [ethics] document partly because it was due at around the exam period, and because I thought that it was unnecessary since we were just working with a group of Secondary 2 students. However, after much discovery of the roles of the Institutional review Board (IRB) in community-based research conducted in NUS, I realised that this document is necessary in minimising risks, such as personal data leakages. The IRB's role in ethically protecting our partner prevents mistrust between the two parties, and is a conceptually small but important part of a research partnership (Hyatt, et. al., 2009)"* Undergraduate 1

In the supervisor's observation, the undergraduates perceived administrative documents as tedious and ineffective during the preparatory phase, but when the rationale was clearly explained especially at the start of the engagement, they could learn from this experience and were more conscious of ethical considerations in their decision making process. These *"ethical principles were subsequently woven into their design and implementation of their questionnaires and discussion"* (Supervisor's reflection).

Pedagogical value of CAPSTONE module – integrative and applied learning

The CBR approach provided the opportunity for the undergraduates to learn concepts derived from different disciplines and equipped them with the skills needed to work cohesively as a team. One notable learning point was that of humility, which was repeatedly mentioned in the reflections,

> *"I really cherished the opportunity to learn from them, and was, on multiple occasions forced to be humble and recognise when others were better suited to a certain task than myself."* Undergraduate 2
> *"In times when I was the one falling short, I did feel guilty and a bit of a burden to the team, but I was reminded of the importance of supporting one another in difficult times, and more importantly, for me to have humility and be accountable for these instances."* Undergraduate 1

They recognized that these skills and knowledge were crucial to their present work and *"believe that the concepts and skills I learnt in this aspect of the project will benefit me in the long run"* (Undergraduate 1). One of them noted,

> *"Through this experience of working with different external agencies, I better understood the importance of networking, and moving forward, I hope to*

continue to remain open to the possibility of meeting new people and building relationships." Undergraduate 2

In the supervisor's interactions with the undergraduates, he observed that the *"students became more prepared for the uncertainty involved in scientific research and were keen to apply these skills to their final year project. For instance, the Environmental Studies major would like to take on a project related to environmental attitudes while the Applied Mathematics major has expressed interest in an interdisciplinary project that bridges Biology and his own discipline"* (Supervisor's reflection). The team was also determined to write up their CAPSTONE project into a scientific publication to share their learning points. Through informal communication, they continued to support and encourage one another in their academic work, even though the project has ended.

The CAPSTONE module enabled undergraduates to synthesize, apply and evaluate their project and hence promoted integrative learning by leveraging on their respective disciplinary strengths. One undergraduate noted,

> *"Besides being exposed to food waste management concepts and pedagogical theories, I was given the opportunity to learn how to design an environmental education programme, and methods to evaluate the effectiveness of our intervention." Undergraduate 1*

Beyond this synergy, the undergraduates were also able to integrate the knowledge gleaned from the community to develop a programme that is relevant for the high school students, by taking into account the barriers they observed. This CAPSTONE project thus bridges formal and informal learning by linking theoretical and empirical evidence to create a programme that is suitable for 14 year olds. The undergraduates were clearly aware of the need to *"constantly reflect and incorporate the views of the community [high school students and teachers] into the programme and this was achieved through weekly discussion and revision of each module to keep it relevant and effective"* (Supervisor's reflection).

Moreover, the experience also prompted them to think about issues on a broader scale and some had began questioning if educators *"should rethink the conventional education model when it comes to environmental stewardship"* and to promote teaching in *"innovative and refreshing ways"* (Undergraduate 2) through collaboration between different parties. The supervisor recalled how the undergraduates remarked that,

> *"Environmental issues cannot be taught in the high schools solely as part of the syllabus to prepare students for high stakes examinations, as the assumption that knowledge directly changes behaviour is invalid."* (Supervisor's recollection)

This *"realisation is critical, as it was evident that the undergraduates were relating this issue on a broader level, and has began to challenge conventional views and assumptions. More importantly, they are asking themselves what their roles are in this issue."* (Supervisor's reflection)

Conclusion

In this study, we described how the connected curriculum framework was useful in anchoring the CAPSTONE module. Through constructive alignment, the ILOs of the CAPSTONE module were aligned to the broader scholarship (i.e. SOLO taxonomy and constructively alignment) and educational aims (i.e. residential college programme ILOs and AAC&U ELOs). This 'inward' and 'upward' alignment identified minor gaps and new learning activities have since been recommended to the supervising staff to enhance the learning value of this module. The CAPSTONE module had very positive outcomes in the 12 selected ELOs and it was evident that CBR can help prepare undergraduates in expanding their skills beyond the intellectual content. The provision of opportunities in higher education to solve 'real-world' problems was a distinct strength of the module. In addition, a carefully supervised CBR project like this, can also benefit the community partner (see Toh and Siok 2018) and the instructors (Toh and Ortiga 2018). Beyond environmental science, the CBR model can be readily applied to other interdisciplinary fields such as urban studies and we strongly encourage educators to leverage on CBR as a pedagogical tool in higher education.

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