Advancing a culture of teaching: Diversity and inclusivity to optimise learning
HECC 2019
Advancing a culture of teaching: Diversity and inclusivity to optimise learning

Contents
Welcome Message
Keynote Lecture
Paper Presentations
PechaKucha Presentations
Gallery Walk (Poster Presentations)
Welcome Message

BY THE CO-CHAIRS

Welcome to the Higher Education Campus Conference (HECC) 2019. As the first part of a new two-day NUS Festival of Learning that joins together different ways of focusing on university teaching, HECC as before aspires to strengthen ties among students, faculty, and staff members within the NUS community. Through this Festival, we seek to explore the integrative potential of learning, research, and teaching.

This year, we are privileged to have our Educator-in-Residence for 2019, Dr Mary Deane Sorcinelli, as our keynote speaker. Dr Sorcinelli, who brings a wealth of experience and insights through her varied academic and leadership roles in higher education, will speak on the topic of how to advance a culture of inclusive teaching excellence on campus.

We are further delighted to present an array of high-quality abstracts for paper, poster, and PechaKucha. Faculty and students will share ideas and good practices that foster diversity and inclusivity in different contexts to optimise student and faculty learning. These presentations, we hope, will stimulate many more conversations on how collectively we as a community can advance a culture of teaching in diverse contexts.

Friends of CDTL who have been involved in our events and activities over the past years might have noticed that this year, we are bringing together three closely related events as one NUS Festival of Learning, which is intended together to advance a culture of teaching. Day 1 of the Festival begins with HECC 2019: a conference for sharing practices in a contextualised and grounded way. This is followed by Learning on NUS Campus, with excellent teachers presenting what—and demonstrating how—they teach. The Festival culminates in a celebration of teaching excellence in the form of the annual Teaching Awards ceremony.

We are grateful for strong support from Senior Deputy President and Provost, Professor Ho Teck Hua, who will speak on lifelong learning and adult education at NUS.

As importantly, we appreciate your presence at and engagement in the NUS Festival of Learning. We would like to thank you for your support and look forward to many productive conversations.
### Programme

18 NOVEMBER 2019 (MONDAY)

<table>
<thead>
<tr>
<th>Time</th>
<th>Auditorium</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.15am-8.45am</td>
<td>Registration @ Lecture Theatre 3 foyer</td>
</tr>
<tr>
<td>8.45am-9.00am</td>
<td>Opening address by Guest of Honour</td>
</tr>
<tr>
<td></td>
<td>Professor Bernard TAN</td>
</tr>
<tr>
<td>9.00am-10.00am</td>
<td>Keynote Lecture</td>
</tr>
<tr>
<td></td>
<td>Chair: Assoc Prof Adrian LEE</td>
</tr>
<tr>
<td></td>
<td><strong>Advancing a Culture of Inclusive Teaching Excellence on Campus</strong></td>
</tr>
<tr>
<td></td>
<td>Dr Mary Deane SORCINELLI</td>
</tr>
<tr>
<td>10.00am-10.30am</td>
<td>Coffee break @ CDTL</td>
</tr>
<tr>
<td>10.30am-10.50am</td>
<td>Paper Presentations</td>
</tr>
<tr>
<td>10.55am-12.05pm</td>
<td>Paper Presentations/PechaKucha Presentations</td>
</tr>
<tr>
<td>12.10pm-1.10pm</td>
<td>Lunch</td>
</tr>
<tr>
<td>1.15pm-1.40pm</td>
<td>Gallery Walk (Poster Presentations)</td>
</tr>
<tr>
<td>1.45pm-3.25pm</td>
<td>Paper Presentations</td>
</tr>
<tr>
<td>3.25-4.30pm</td>
<td>Closing Reception</td>
</tr>
</tbody>
</table>

**From Presentation to Publication**
- Meet the AJSoTL Editors
## Paper Presentations / *PechaKucha* Presentations

<table>
<thead>
<tr>
<th>Time</th>
<th>Dewey</th>
<th>Piaget</th>
<th>Vygotsky</th>
<th>Meadows Cluster</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.30am-10.50am</td>
<td>Reflective Learning: How getting students to spot mistakes enhances learning</td>
<td>Portfolio writing at higher education to support lifelong learning</td>
<td>Learning partnerships to co-construct knowledge and foster diversity in the classroom</td>
<td>Sadaf ANSARI, RVRC</td>
</tr>
<tr>
<td></td>
<td>CHIAN Siau Chen, Department of Civil and Environmental Engineering, FoE</td>
<td>PARK Mihi, Centre for Language Studies, FASS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.55am-11.15am</td>
<td>Research-based versus work-integrated learning programmes: Is one better than the other in training employability skills and attributes?</td>
<td>Empowering engineering students: Why and how? A case study in environmental engineering</td>
<td>Digitization of teaching materials to complement online learning</td>
<td>LEE Lai Yeng Cindy, Department of Chemical and Biomolecular Engineering, FoE</td>
</tr>
<tr>
<td></td>
<td>LAM Siew Hong &amp; Cynthia HE, Department of Biological Sciences, FoS</td>
<td>Olivier LEEFEVIRE, Department of Civil and Environmental Engineering, FoE</td>
<td></td>
<td>My digital journey with FA1102—Leveraging Community of Inquiry for greater inclusivity</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LUU Tran Huynh Loan Jodie, CELC</td>
</tr>
<tr>
<td>11.20am-11.40am</td>
<td>Insights into an interdisciplinary project on critical reflection in Nursing</td>
<td>Considerations for inclusive education in online curriculum design</td>
<td>Undergraduate teaching assistants as co-curators for the “Learning to Learn Better” module: What they did and what they learned</td>
<td>LAM Wanli Aileen, CELC</td>
</tr>
<tr>
<td></td>
<td>Dr Namala Lakshmi TILAKARATNA, Dr Mark BROOKE &amp; Dr Laetitia MONBEC, CELC</td>
<td></td>
<td></td>
<td>Hui Ru TAN¹,²,⁴, Aaron R. JEARA⁴,⁵, Balakuru S/O Madendran⁵, Jing Yi POH⁴,⁵, Magdeline Tao Tao NG¹,⁷, Robert K. KAMEI¹,⁴, Joshua J. GOOLEY¹,⁸,⁹ and Fun Man FUNG¹,¹⁰ #1</td>
</tr>
</tbody>
</table>
### Paper Presentations / PechaKucha Presentations / Gallery Walk

<table>
<thead>
<tr>
<th>Time</th>
<th>Dewey</th>
<th>Piaget</th>
<th>Vygotsky</th>
<th>Meadows Cluster</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.45am-</td>
<td>Authentic learning in a postgraduate applied</td>
<td>Evaluation of peer assessment in the technology-enhanced</td>
<td>Students/Teachers co-creating low-cost virtual excursions and experiential</td>
<td></td>
</tr>
<tr>
<td>12.05pm</td>
<td>physics course</td>
<td>teaching of patient presentation skills</td>
<td>learning using 360° videos and annotation tools</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CHAN Taw Kuei, Department of Physics, FoS</td>
<td>HAN Zhe, Department of Pharmacy, FoS</td>
<td>Christoph Dominik ZIMMERMANN¹, Alvita ARDISARA², Foon Yin FUNG₄, Shaphyna</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Nacqiar KADER¹, Gopalakrishnakone P¹, London Lucien OOI⁴,⁵, Fun Man</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>FUNG², Afiq Bin Dolkifil⁴, Arvindaraj Pillay S/O Thangaraj⁵, GOH</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Jin Yang⁸, Jonathan WU⁴, Vanessa LIM Zi Kun⁴, Xavier COUMOUL⁶, Etienne</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BLANC⁷ #²</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Inclusive learning in classroom curricula and activities through</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>authentic learning pedagogy</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>KUAN Yee Han, Tembusu College</td>
<td></td>
</tr>
<tr>
<td>12.10pm-</td>
<td>Lunch</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.10pm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Paper Presentations/PechaKucha Presentations/Gallery Walk

### Gallery Walk (Poster Presentations)

<table>
<thead>
<tr>
<th>Time</th>
<th>Dewey</th>
<th>Piaget</th>
<th>Vygotsky</th>
<th>Meadows Cluster</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.15pm-</td>
<td></td>
<td></td>
<td>Effects of planetarium-based instruction on undergraduates learning astronomy</td>
<td>Creating an inclusive outdoor learning framework in a residential college</td>
</tr>
<tr>
<td>1.40pm</td>
<td></td>
<td></td>
<td>Ummu Sumaiyah Binte ELIASE &amp; NG Shao Chin, Cindy, Department of Physics, FoS</td>
<td>LIM Cheng Puay &amp; Norman NEW Chin Guan, RVRC</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Exploring students’ perception of feedback in computing internships</td>
<td>Making thinking visible</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Bimlesh WADHWA, SoC, Mark GAN, CDTL, Li Shiyu, BIZ &amp; Sarah CHEAH, BIZ</td>
<td>Amy CHOONG Mei Fun, Department of Biological Sciences, FoS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.45pm-</td>
<td></td>
<td></td>
<td>Fostering interdisciplinarity through blended learning</td>
<td>Design charrette pedagogy in flipped classroom to enable creative exploration outside design studio: A case of Environmental Systems module in architecture education</td>
</tr>
<tr>
<td>2.05pm</td>
<td></td>
<td></td>
<td>Why do students perform the way they do? Uncovering the truth with eye-tracking technology</td>
<td>NOOPUR Joshi &amp; LAU Siu-Kit, Department of Architecture, SDE</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Joseph XU Weijian, KOH Mun Yee Sarah &amp; FOONG Weng Chiong Kelvin, Dentistry</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.10pm-</td>
<td></td>
<td></td>
<td>Using a social annotation tool in the Ideas and Exposition Module (IEM) classroom</td>
<td>Assessing learning outcomes of embedding leadership communication skills in an information systems leadership course</td>
</tr>
<tr>
<td>2.30pm</td>
<td></td>
<td></td>
<td>Assessing learning outcomes of embedding leadership communication skills in an information systems leadership course</td>
<td>Reflections on Practice: Technology-enhanced strategies to promote long-term student learning</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>OH Lih Bin, Department of Information Systems and Analytics, SoC &amp; Chitra SABAPATHY, CELC</td>
<td>Mrinal MUSIB, Department of Biomedical Engineering, FoE</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>Dewey</td>
<td>Piaget</td>
<td>Vygotsky</td>
<td>Meadows Cluster</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>2.35pm-2.55pm</td>
<td>Smart devices, smart learning: Winning students’ attention in large classes</td>
<td>Project-centric approach and student’s metacognition in creating an authentic learning environment to enhance student’s engagement in teaching bioinstrumentation—A case study</td>
<td>I have a voice: Helping students’ critical thinking be heard in an academic writing course</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CHIAN Siau Chen, Department of Civil and Environmental Engineering, FoE</td>
<td>James Chen Yong KAH, Department of Biomedical Engineering, FoE</td>
<td>Daron Benjamin LOO &amp; Sylvia SIM, CELC</td>
<td></td>
</tr>
<tr>
<td>3.00pm-3.25pm</td>
<td>Clickers to scaffold higher cognitive thinking in traditional lecture class: An evidence-based study of architecture students</td>
<td>Not in class: The seats left empty by high-ability students from low-income backgrounds</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>LAU Siu-Kit &amp; Noopur JOSHI Department of Architecture, SDE</td>
<td>Eqtaffaq Saddam Hussain Bin GULAM HUSSAIN, Yale-NUS College</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.25pm-4.30pm</td>
<td>Closing Reception</td>
<td>From Presentation to Publication</td>
<td>Meet the AJSoTL Editors</td>
<td></td>
</tr>
</tbody>
</table>
Keynote Lecture

Advancing a Culture of Inclusive Teaching Excellence on Campus
Dr Mary Deane SORCINELLI
University of Massachusetts Amherst
USA
Advancing a Culture of Inclusive Teaching Excellence on Campus

Synopsis

With growing pressures for accountability, reduced funding, competition from alternative providers, and serious questions about how to meet the challenges of a changing workforce, these are difficult times for higher education. But there is good news as well, as the focus on teaching and learning assumes a much more prominent place on the academic landscape.

Many colleges and universities today have established centers for teaching excellence that support the work of faculty looking to improve their students’ learning. A growing number of campuses are actively gathering evidence of student learning to guide innovation and improvement. Many campuses have also worked to reshape rewards and incentives in ways that encourage faculty to spend time and intellectual effort improving the learning experience of their increasingly diverse students. And all of this work has taken on greater urgency as higher education confronts the social imperative to support the success of all students—especially those that have not traditionally been well served by colleges and universities.

New classroom practices, though critical, are not enough to meet the challenges facing higher education. This keynote highlights the importance of a larger context—a campus culture—in which teaching and learning are a focus of sustained attention, inquiry, and improvement by all members of the campus community. But what are the distinguishing features of such a culture and how are such cultures built, nurtured, and sustained? In this session, we will 1) identify the critical, defining indicators of a culture of teaching and learning; 2) explore levers for cultivating such a culture in ways that respect disciplinary differences; and 3) strategize about opportunities for strengthening a culture that supports powerful and equitable learning for all members of the campus community: students, faculty, and staff.

Mary Deane SORCINELLI
University of Massachusetts
Amherst
USA
Advancing a Culture of Inclusive Teaching Excellence on Campus

About the Speaker

Dr Mary Deane SORCINELLI is Co-PI, Undergraduate STEM Education Initiative, Association of American Universities (AAU) and Senior Fellow, Institute for Teaching Excellence & Faculty Development, University of Massachusetts Amherst. Previous roles include Associate Provost, Professor, and Founding Director, Center for Teaching & Faculty Development, UMass Amherst and Director, Office of Faculty Development, Indiana University Bloomington.

Mary Deane's research is in the areas of faculty professional development, mentoring, scholarly writing, improvement of teaching and learning, and the role of teaching centers in fostering 21st century faculty learning. She has published over 100 articles, book chapters and books, most recently co-authoring A Center for Teaching and Learning Matrix (2018). She has co-directed and advised grant-funded projects aimed at promoting educational innovation for the National Science Foundation (NSF), Andrew W. Mellon Foundation, Microsoft, and the Carnegie Foundation for the Advancement of Teaching.

Mary Deane served as President of the Professional and Organizational Development (POD) Network in Higher Education, the oldest and largest faculty professional development association in the world. She was honoured with the Spirit of POD Award for outstanding lifetime achievement and leadership in faculty development. She served as Distinguished Scholar in Residence, Mount Holyoke College and Senior Scholar, American Association for Higher Education (AAHE). She has worked in some 15 countries and was awarded a Fulbright Specialist to Education City, Qatar, a Distinguished Visiting Professor, American University in Cairo, Egypt, and a Whiting Foundation Fellow, National University of Ireland Galway.

Mary Deane holds an M.A. in English Literature from Mount Holyoke College and an ED.D. in Educational Policy from UMass Amherst.
Paper Presentations
Reflective learning: How getting students to spot mistakes enhances learning

CHIAN Siau Chen
Department of Civil and Environmental Engineering, Faculty of Engineering
sc.chian@nus.edu.sg

The objective of education is learning. It involves imparting valuable knowledge to students and cultivating their interest in the subject matter. Students should be confident and eager to apply the knowledge gained in their careers. This way, they would be intrinsically motivated to innovate and add value to the work assigned to them. These are analogous to the essence of the taxonomies of educational objectives outlined by Anderson and Krathwohl, which involve knowledge-based, skills-based and affective goals (Anderson et al., 2001). Course materials and assessment should be crafted to achieve these goals. Furthermore, effective imparting of knowledge should also encompass ways to enhance subject retention, comprehension of concepts, and finally, application to various relevant situations.

Past research studies focused mainly on the development of additional teaching materials, particularly technology-aided tools (Rehak & Schields, 1984; Ebner & Holzinger, 2002). Unfortunately, the development of more teaching materials does not necessarily translate to effective cognitive learning. In fact, such materials may discourage students who are already struggling to keep up with their existing academic workload, while encouraging others to memorise more worked examples. In view of these concerns, an initiative to revamp the traditional approach in graded assignments was implemented and the findings are presented in this study.

In graded assignments which used conventional formats, students were commonly graded based on the level of completeness of their workings rather than their understanding of concepts. The lecturer’s gauge of the students’ level of understanding would also be limited to the students’ workings which may not accurately reflect their thought process while attempting the assignments. Post-marking feedback thus may not be truly valid. An alternative format was proposed, which required students to identify mistakes in a set of given workings and to explain why these workings were incorrect. In the process of analysing the mistakes, students gained a deeper understanding of the subject and were enriched by the learning experience. A total of 243 engineering undergraduates participated in the study. Following the completion of the assignment, an anonymous questionnaire was disseminated to collect essential information on students’ interests, learning, preferences and self-efficacy. The responses were separated according to the year of study: 2nd year (Group X) and 3rd year (Group Y) undergraduates. The module taken by Group X was an introductory soil mechanics engineering subject, while Group Y was based on an advanced engineering module which was also related to soil mechanics. The format of the assignments for both modules over the years were identical, although the questions in the assignment for Group X are more conceptual while those for Group Y are more...
applied in nature. This offered greater diversity in terms of the students’ ability to analyse the assignment questions, although similar observations between the two groups may be affected by inherently different factors.

Based on the responses to the questionnaire, majority of students gave positive feedback about the alternative format. They enjoyed the “reverse-thinking” process and many found the workings useful in providing a frame of reference to solving the problem. It also helped them understand the concepts better rather than merely assessing their ability to solve standard problems. However, students were also relatively comfortable with the conventional format due to its familiarity. In terms of the learning experience, a large proportion of students felt that the alternative format enhanced their learning and thinking abilities (Figure 1). With respect to self-efficacy, most students felt positive in doing better (Figure 2).

![Graph A](image1.png)

**Figure 1.** Comparison of students’ responses towards the alternative and conventional style assignments (Group X). (a) Comparison of learning benefits, (b) Persistence analysis.

**Note:**
- Each alphabet refers to each of the three criteria: 1) Interests them more; 2) Enhances learning better, and 3) Enhances thinking ability better.
- Alphabet ‘A’ and ‘B’ refers to Assignment A and B respectively.
Figure 2. Comparison of students’ self-efficacy levels and their expected grades (Groups X and Y).

Based on the grades obtained, students fared better in the assignments which adopted the conventional format (Figure 3). When comparing students’ expected and actual assignment grades, it was found that the students were generally over-optimistic about their grades (Figure 4). Further analysis also showed that students who were academically inclined obtained higher grades in subsequent semesters over the course of their undergraduate studies, while academically weaker students may not benefit from the new format as significantly (Figure 5).

Figure 3. Comparison of grades obtained by students in the alternative and conventional style assignments (Group X).
In summary, the alternative format has shown to be successful in achieving its objectives in stimulating students' interests, as well as levels of learning and self-efficacy, especially in engineering modules where assignments are generally mathematical in nature and it is difficult to assess students' actual levels of understanding. Wider application of such pedagogy in higher education learning would instil in students a deeper understanding of the subject and higher levels of confidence in tackling complex engineering challenges in their future careers. Further studies over a longer term and across different proficiencies of student groups on similar initiatives would enable educators to do a more holistic evaluation of the reflective learning method, particularly the extent in which this approach would lead to improvements in the levels of learning and self-efficacy in engineering subjects.
Keywords
Assignment; mistakes; preference; learning experience; self-efficacy

References


Lifelong learning is a topic which is actively discussed in higher education. In a dynamic society where change is constant and a piece of useful knowledge may become useless tomorrow, a person’s learnability, that is, their ability to acquire necessary knowledge at any point of life, becomes more important than the quantity of knowledge they acquire now (Daily FT, 2017). As a result, educators are becoming more interested in nurturing critical thinking and learnability, and encouraging learners to view learning as a lifelong activity.

According to a well-known discussion on reflection by Dewey (1933), the concept includes critical thinking, and the reflective activity should be constructive. Meanwhile, metacognition is another important factor of learning which is closely related to reflection, since it was defined as reflective consciousness or inner speech by Vygotsky (1986). Additionally, active monitoring is a key aspect of metacognition (Flavell, 1976), and critical thinking and monitoring are terms repeatedly used to describe the reflective and metacognitive aspects of learning. Merriam and Bierema (2014), in fact, explicitly explain that critical thinking includes reflection and the monitoring process. To sum up, lifelong learning is attributed to enhanced reflective and metacognitive skills, because being equipped with critical thinking abilities would allow learners to assess assumptions, beliefs, and actions, which are necessary life skills (Merriam & Bierema, 2014).

A learning portfolio refers to a collection of documents and artefacts that serve as evidence to support claims a person makes about what they know, what they have achieved, and what they can do (Stefani et al., 2007). Among the known benefits of a learning portfolio, reflection and metacognition are the skills learners can attain while producing a portfolio (Council of Europe, 2019), which would enable them to potentially develop their capacity for lifelong learning.

Therefore, the module LAK4201 “Korean 5” at NUS adopts the learning portfolio approach to enhance learners’ autonomy and lifelong learning. Students were asked to submit a ‘Language Passport’ (Council of Europe, 2019) before the start of the semester. The Passport would help students get started on their portfolios by reflecting on their past experiences of learning languages, and for the lecturer to gain a better understanding of students’ respective backgrounds. Importantly, the aim of portfolio writing is thoroughly explained to the students, so that they would maximise the learning opportunities presented by this activity. During the semester, students were required to submit two types of works: a weekly written reflection with guiding questions, and five task-based assignments. A thematic approach was employed to analyse the weekly reflections, following procedures suggested by Hamp-Lyons and Condon (2000). Metacognitive or
reflective comments on his/her own learning activities were identified based on the Strategy Inventory for Language Learning (Oxford, 1990) which was used to evaluate how well learners used metacognitive strategies to learn a language.

The comments collated indicated that students reflected on the learning activity and the process meticulously (e.g. “The examples didn’t help me understand X because they were out of context”), were aware of cross-linguistic differences (e.g. “I will try to learn the expressions because they don’t exist in English but are used frequently in Korean”; “I realised [there are] various words to address family members in Korean, perhaps because family is such an important unit in Korean culture”), were able to apply prior knowledge from past language learning experiences (e.g. “I realised that the new sentence structure is similar with the one that we learnt last semester”; “I wonder how they [two constructions] are different in usage”), and plan for the next stage of the language learning process (e.g. “It was not as easy as it looks at the beginning of writing Assignment 1. Although I had plenty of ideas and examples to write about, it was difficult to organise them in an efficient and coherent way. I think I need to practise writing longer and complex sentences”).

The findings indicate that writing a portfolio of the language learning process enhanced students’ capacity for meticulous reflection and their involvement in metacognitive activities, which would ultimately support lifelong learning.

Keywords
Portfolio, lifelong learning, metacognition, reflective learning, language learning

References


Learning partnerships to co-construct knowledge and foster diversity in the classroom

Sadaf ANSARI
Ridge View Residential College
rvrsa@nus.edu.sg

An increase in global interdependencies and migration, and more recently the advent of lifelong learning has led to educators placing greater emphasis on the need for inclusion and diversity in higher education (Lorraine & Blessinger, 2017). However, research has indicated that the transition to university education can be challenging, especially for learners from less privileged, culturally different or marginalised backgrounds. While the university can offer greater autonomy to learners from diverse backgrounds, such learners may also encounter increased competition or hostility from peers (Kalsner & Pistole, 2003). This can result in feelings of social anxiety and fear, which can have a negative impact on the learner. Ensuring that learners have the necessary support, are able to build relationships, develop multicultural skills with members from diverse backgrounds, and are equipped with the ability to participate in a pluralistic community can mitigate some of the problems mentioned (Locks, 2008). Living-learning communities, by virtue of being smaller and connected yet diverse, can address such needs (Inkelas, 2008). As such, the classroom setting in a living-learning community provides teachers and learners an invaluable opportunity to nurture and sustain a culture of inclusion and diversity.

This paper considers how inclusivity can be fostered when knowledge is co-constructed by learners in a living-learning community. The paper takes a holistic approach to diversity; narrow definitions often concern only specific groups of learners or attributes, or the mainstreaming of special education. This paper addresses more common descriptions that focus on the diversity of learners in terms of ethnicity, gender, language, and socioeconomic backgrounds. The teaching strategies advocated are grounded in existing literature, and use classroom observation as a key point of reference. The paper argues that co-construction of knowledge can foster the sharing of diverse perspectives by: 1) creating a partnership that lead learners to relate concepts to existing knowledge and each other’s perspectives, 2) critically evaluating ideas, and 3) providing feedback for the shared narrative of classroom learning. Collectively, these can create a culture that reflects all learners that make up the learning partnership and ideas would be treated with equal respect.

Co-construction is a broad umbrella that encompasses different strategies. The paper focuses on the co-construction strategy of establishing learning partnerships between the teacher and the learners; where the learners become active participants in the learning process and construct knowledge in collaboration with the teacher. This strategy requires a high level of learner engagement, while simultaneously enhancing it further. Being situated in a living-learning community facilitates the adoption of the strategy for the classroom due to prior familiarity between learners. The resulting improvement in learner engagement can, in turn, feed forward to more inclusive community interactions.
An action research model was adopted, primarily to enable dynamic improvements to teaching strategies for four different modules and their content. The learners were in their first two years of undergraduate study and from multidisciplinary backgrounds. Class sizes were relatively standard, ranging from 12 to 15 learners, with a total of 90 learners. Subject content for the four case examples under consideration range from environmental sustainability and landscape changes to heritage conservation and marine pollution. Lesson plans were designed to enable learners greater control over the framing of questions to be explored, while ensuring high degree of collaborative interaction to foster inclusivity. Qualitative data was collected in the form of observations about classroom interactions and discussions, learner notes and reflective essays. These were analysed using text analytics tools such as word frequency and sentiment analysis to understand perceived learner benefits about inclusiveness. The research team also examined teacher observations and notes which recorded the benefits of the process of co-constructing knowledge in the classroom. Based on the results, the paper holds that co-construct of knowledge enable learners to reap benefits such as agency, enhanced engagement, motivation and learning, and enhanced meta-cognitive awareness, and this in turn promotes inclusivity.

Keywords
Co-construction, diversity, learning partnership, living-learning, community

References


Research-based versus work-integrated learning programmes: Is one better than the other in training employability skills and attributes?

LAM Siew Hong and Cynthia HE
Department of Biological Sciences, Faculty of Science
dbslsh@nus.edu.sg*

Graduates with employability skills and attributes are perceived to adapt, perform and progress better in the modern workplace (Succi & Canovi, 2019). Employers expect the undergraduate programmes in universities to produce graduates with such skills and attributes to meet the changing demands of the workforce (Tomlinson, 2008). Both research-based learning (RL) and work-integrated learning (WIL) programmes have long been used to equip undergraduates with skills and attributes that would enhance their employability (Crebert, Bates, Bell, Patrick, & Cragnolini, 2004; Seymour, Hunter, Laursen, & DeAntoni, 2004). While both types of programmes have been successful (Jackson, 2015; Stanford, Rocheleau, Smith, & Mohan, 2015), in terms of the perceived learning of employability skills and attributes, no comparison has been made between science students who had undergone RL and those who went through WIL. Such an investigation is important in terms of enhancing the training of science undergraduates, where RL has been considered the traditional approach and WIL is gaining wider adoption. This study compares the perceived importance and learning of employability skills and attributes in students who had undergone either the RL or WIL programmes under the NUS Life Sciences curriculum. It also investigates the perceived difficulty of these training programmes and their perceived usefulness in preparing undergraduates for future employment and work-readiness.

An online survey was conducted for fourth year Life Sciences undergraduates at the end of their self-selected RL or WIL programmes. The total respondents consisted of 171 and 147 students who completed their respective RL and WIL programmes as part of their graduation requirements. The study investigated 18 items that can be broadly grouped under five categories. They are: (I) Disciplinary Knowledge and Skills, (II) Ethics and Professional Awareness, (III) Thinking Skills, (IV) Information, Communication and Interpersonal Skills and (V) Employability Attributes. The investigated items were adapted from studies by Rayner and Papakonstantinou (2015), and by Sarkar, Overton, Thompson, and Rayner (2016), who compiled a list of knowledge, skills and attributes based on a substantial literature review followed by surveys conducted on science graduates and their employers. The items are broadly aligned with the seven key skills framework proposed by Washer (2007) and seven key competencies reported by Mayer (1992). Using a five-point or seven-point Likert scale, students were asked to rate the items in the questionnaire. Descriptive statistics were generated and student’s t-test was employed to infer statistical significance of mean ratings between students from both the RL and WIL programmes.
In addressing the perceived importance of the 18 items in the respective training programmes, it was found that all the items had average ratings of above 5 (Quite Important) except for “Disciplinary Skills” which was rated by WIL students. Based on the mean ratings, the top and bottom three items rated by RL and WIL students were distinctly different. The findings suggest that differences in perceived importance by RL and WIL students may motivate learning of knowledge, skills and attributes differently.

In addressing perceived learning, RL students retrospectively indicated lower average ratings compared to WIL students in all 18 items, and the ratings of five items were highly significant at the start of their training programme. With the exception of “Disciplinary Skills”, RL students indicated lower average ratings than WIL students on 17 items, and the ratings for 12 items were highly significant at the end of their training programme. However, the average gain in rating was significantly different for six items only. The findings suggest that RL students tended to rate themselves lower than WIL students with respect to their employability skills and attributes, although the learning gain was comparable for some of the items.

Interestingly, 63.9% of RL students rated their work as ‘Difficult/Very Difficult’ compared to only 19.3% of WIL students. Moreover, only 66% of RL students rated their training program as ‘Useful/Very Useful’ in preparing them for their future employment compared to 89.5% of WIL students. Nevertheless, 81.6% of RL students were ‘Quite/Absolutely’ confident about joining the workforce compared to 97.1% of WIL students. Taken together, the findings suggest that the RL programme was perceived less positively compared to the WIL programme in terms of equipping students with employability skills and attributes. This may be due to the differences in awareness of employability skills and attributes between RL and WIL students during the survey. The limitation of the present study is that it was based on students’ perceptions only. Extending it beyond student perception may require further assessment of employability skills and attributes.

**Keywords**
Research-based learning, work-integrated learning, employability skills and attributes, Science undergraduates.

**References**


Empowering engineering students: Why and how? A case study in environmental engineering

Olivier LEFEBVRE
Department of Civil and Environmental Engineering, Faculty of Engineering
cceelop@nus.edu.sg

The need for engineers in today’s society is greater than ever, resulting in a large public investment made to prepare precollege students for an engineering education. However, the attractiveness of engineering as a discipline has decreased over time. Furthermore, the attrition rate is very high and this represents both a loss to the engineering workforce and a loss of return to public investment (Godfrey, Aubrey, & King, 2010; Meyer & Marx, 2014). Most engineering students leave engineering due to deficits in academic and career advising, engineering structure and curriculum, insufficient high school preparation, disinterest or disappointment in the field (Meyer & Marx, 2014). Another primary reason for the high attrition rate among engineering students is the perception that the engineering learning environment is unwelcoming and fails to motivate them. The importance of early commitment in the retention of engineering students has been discussed extensively by Li, Swaminathan, and Tang (2009).

In engineering, as in many other disciplines, student empowerment is increasingly a focus of concern, driven by the complexity of a rapidly evolving industry in the 21st century. The new engineer can be defined as an “out-of-the-boxer” (Miller, 2016), characterised by an adaptive, creative, innovative and optimistic mindset. No longer the “technical manager”, he has evolved to become the interface between the team that handles the technical aspects, his management and the clients. In this context, the engineering curriculum needs to adapt in order to train students to work under scenarios characterised by uncertainty, complexity and innovation, while keeping them interested and promoting intrinsic motivation (Smith-Sebasto, 1995).

Studies have shown that students are more likely to be intrinsically motivated if they attribute their educational results to factors within their control (Smith-Sebasto, 1995). Autonomy is best promoted through active learning and interactivity. One way to develop extrinsic motivation is via peer education, under the close supervision and intervention of the teacher. In a 2016 seminar at NUS, Eric Mazur, Chair of applied physics at Harvard, showcased how he encourages students to continuously help each other (Yang, 2016). More recently, Guntzburger, Pauchant, and Tanguy (2019) proposed an active learning method to empower engineering students based on complex case studies and role play. Another important aspect of empowering students is through complex multifaceted group projects (Papadopoulou, Lytras, & Marouli, 2016), including cross-disciplinary activities as well as in non-technical areas, including critical thinking, communication and the humanities (Ballatore, Montanaro, & Tabacco, 2019; Greculescu & Todorescu, 2017).
In this presentation, I will showcase my incorporation of authentic projects (Herrington, 2005) in a flipped classroom mode for an environmental engineering module. The projects were developed in partnership with the National Environment Agency (NEA) and the Ministry of Education (MOE) to increase waste awareness across various schools in Singapore. The objective of the study was to analyse the effectiveness of this authentic learning approach on improving students' levels of engagement and learning performance by using a mix of qualitative and quantitative statistical methods. The conceptual framework is summarised in Figure 1, and the connection between engagement and authentic learning was verified empirically by means of focus group interviews and questionnaires, followed by statistical analysis.

![Figure 1. Correlational analysis and regression analysis.](image)

High Pearson correlation coefficients (in **bold**) and high linear regression coefficients (in parentheses) in Figure 1 demonstrate the positive correlation between authentic learning, engagement and learning performance. We transcribed and analysed the focus group interviews into three main themes: workload and effectiveness of teaching method, peer interactions and review, and real-life reflection. A student commented that “Though it was extremely tedious, tiring and inconvenient, I particularly found the NEA project meaningful and certainly appreciate the effort put in with NEA and the schools to prepare the class for this project.”

In conclusion, one wonders who should work harder: teachers or students (Groh & Ieee, 2016)? Empowering students does not mean the teacher abdicating control of the classroom. However, it certainly implies a new role for the teacher, which can be seen as being similar to that of a coach (Groh & Ieee, 2016). By giving students ample time to explore and develop their ideas, support innovation, reward risks, promote research and peer review (as well as self-review), we can empower students to ensure that they remain relevant throughout their working lives.

**Keywords**
Active learning, authentic learning, engagement, motivation, project-based learning
References


Insights into an interdisciplinary project on critical reflection in Nursing

Namala Lakshmi TILAKARATNA, Mark BROOKE®, and Laetitia MONBEC
Centre for English Language Communications
elcmb@nus.edu.sg®

This paper provides a description of the first and second stages of a pedagogical research project consisting of an interdisciplinary collaboration between nursing disciplinary experts from the Alice Lee Centre for Nursing Studies (ALCNS) and academic literacy experts from the Centre for English Language Communication (CELC) at NUS. The project entitled “Reflecting Across the Disciplines” explores the highly valued skill of ‘critical reflection’ in nursing undergraduate clinical modules drawing on rigorous theoretical frameworks that make visible salient linguistics resources (Systemic Functional Linguistics/SFL) and knowledge practices (Legitimation Code Theory/LCT). We ask the following research questions: what constitutes ‘deep reflection’ in clinical nursing practice? How can we make ‘deep reflection’ explicit and visible in creating effective pedagogic interventions? Our ultimate aims are to develop an assessment rubric and an online pedagogical intervention for students based on our analyses.

The first stage of the project involved the collection of student critical reflection assignments and their analysis using genre pedagogy (Martin & Rose, 2008), appraisal (Martin & White, 2005), and semantic waves (Szenes, Tilakaratna, & Maton, 2015; Tilakaratna, Brooke, & Monbec, forthcoming). These tools are used to explore the kinds of language and knowledge practices that are privileged in critical reflection written assessments. The texts were selected based on the marks allocated by the nursing faculty at ALCNS without input from the literacy experts. The purpose of this analysis was to identify textual features of these assignments which can be taught to a diverse cohort of nursing students in order to improve their writing. The findings presented are in three main areas of analysis: Generic Structure (the expected stages of the critical reflection process); Evaluation (the targets and types of evaluative meanings that demonstrate critical reflection); and Semantic Gravity (the types of knowledge provided at the personal experiential level and at the abstract, theoretical level).

The second stage of the project involved the rubric development for student critical reflection assignments based on the analyses conducted during Stage 1. This then led to producing an online pedagogical intervention based on our analyses. Gibbs’ (1998) reflective cycle was already implemented as scaffold in the nursing faculty to guide the teaching and assessment of critical reflections before the start of the research. However, nursing faculty in the form of their recent research (Wu, et al., 2016; Wu, et al., 2015) identified that students tend to write reflections that are predominantly descriptive in nature and lack criticality, despite the use of Gibbs (1998) as a model for the process. The authors worked collaboratively with the nursing faculty to construct an assessment rubric that could effectively integrate both the content of Gibbs’ cycle (description; feeling; evaluation; conclusions; and action) and their own findings based on the three main areas of analysis, Genre Structure; Evaluation; and Semantic Gravity. The outcome of this second phase is
presented. The new structure proposed for the teaching and assessment of critical reflections covers 5 stages: orientations (both general and specific); a critical incident/trigger event; an excavation process; transformation; and finally a coda. The presentation will show how these stages can align with the five stages outlined by Gibbs' reflective cycle. It will also demonstrate in detail, through text analyses of valued student critical reflections, how our evaluations from SFL and LCT can inform how students can successfully write reflections at the discourse and lexico-grammatical levels. The frameworks can also pinpoint how students can avoid writing descriptively based on general patterns observed in the collated student data. Finally, the authors will provide an overview of the content of the online pedagogical intervention, and share preliminary results from focus group and group discussions with nursing faculty and students about its effectiveness.

Keywords
Critical reflection; clinical nursing practice; assessment rubric development; Systemic Functional Linguistics; Legitimation Code Theory.

References


The delivery of transferable skills to postgraduate students is becoming increasingly important, due to the need for skilled and adaptable researchers in the modern, dynamic research landscape. This has led to some countries such as Australia, the United States and the United Kingdom (Gilbert et al., 2004) to issue common sets of guidelines to their universities with regards to the transferable skills that all research students in higher degree programmes should be trained in. In Physics Education Research (PER), studies have been done on the various aspects of teaching and learning in physics, such as the conceptual change in students (Dewey, Boyle, & Monarch, 1992), students’ belief about learning physics (Adams et al., 2006), problem solving skills (Leak, Rothwell, Olivera, & Zwickl, 2017) and gesture analysis (Scherr, 2008). There were also much discussion on the transferable skills training at the postgraduate level (e.g. Bromley, Boran, & Myddelton, 2007; Gilbert et al. 2004; Parker, 2012; Leak et al., 2017; Cargill, 2004). In particular, the study by Leak et al. (2017) noted certain characteristics of how physics postgraduate students perform problem solving, where students often seek help from their peers or people that are close to them to solve complex problems. O’Byrne, Mendex, Sharma, Kirup, and Scott (2008) surveyed graduates of PhD physics degrees as well as their employers on their perception of postgraduate physics education. According to the survey findings, graduates felt that the most positive aspects of their education were the opportunities they had to take ownership of their PhD project within an environment that provided them with good supervision and the collaborative support, while employers indicated that there was a significant deficiency in oral and written communication skills among the graduates. Both these studies emphasise the importance of interpersonal and communication skills, as well as the opportunity for and the experience in collaborative work in postgraduate physics education.

In this work, authentic tasks were implemented for a postgraduate applied physics course in the National University of Singapore (NUS), based on the authentic learning guidelines by Herrington and Herrington (2006). The research question is whether this implementation enhances the training of transferable research skills. Authenticity in this work is based on the context of a post-PhD research career. The practices of applied physics research and the discourse at a scientific conference were simulated as part of the continuous assessment component of the course. Three main tasks were incorporated into the course: (a) literature review on a specific topic related to the course, (b) creation of a group poster and (c) giving individual oral presentations, in a format similar to paper presentation sessions at a conference. A poster session was also organised to allow groups to mingle and view the posters of other groups. The aim was for students to gain experience in teamwork, interpersonal communication, as well as the articulation of ideas to their peers during group meetings. Students will also be exposed to complex real-life research questions, the problems encountered, and the methods and steps of how they are resolved by actual researchers. This constitutes an illustration of how students can apply the knowledge gained during class in a real-life setting.
ANOVA analysis of selected end-of-term student feedback questions over 9 academic years was conducted to test whether there is significant impact when the course adopted this authentic learning structure from a previously more traditional course structure. Results indicate that there was significant impact on the students’ perceptions on three areas: the provision of timely and useful feedback, the encouragement of independent and self-directed learning, and the overall effectiveness of teaching. This authentic learning structure, however, had no significant impact on the enhancement of thinking ability as well as an increase in levels of interest in the subject matter.

**Keywords**
Authentic learning, postgraduate education, applied physics education

**References**


Pharmacists are required to present patient information and therapeutic plans to colleagues and other healthcare providers (ACCP, 2014; SPC, 2018a). As such, pharmacy students must demonstrate competency in such skills prior to registration, per competency standards set by the Singapore Pharmacy Council (SPC, 2018b).

At the National University of Singapore (NUS), undergraduate pharmacy students are exposed to patient presentation skills in the module PR3137 “Pharmacy Professional Skills Development III”. They learn in an authentic environment using mock electronic medical records and engage in active learning by conducting an anonymous peer assessment of their classmates’ audio-recorded patient presentations using a standardised assessment rubric. Peer assessment is an important facilitator of positive learning outcomes in higher education (Schneider & Preckel, 2017) and had been successfully implemented in many pharmacy education contexts (Storjohann, Raney, & Buckley, 2015; Bartelme & Brown, 2016). However, its use in teaching patient presentation skills and students’ accuracy in assessing their peers have not been thoroughly studied.

The objectives of this study are to describe undergraduate pharmacy students’ attitudes and perception of peer assessment as a pedagogical strategy in learning patient presentation skills and to evaluate their accuracy in assessing patient presentations as compared to faculty and post-graduate teaching assistants (PG-TAs).

A cross-sectional study was conducted with a convenience sample of 178 students enrolled in PR3137 in Academic Year (AY) 2018/19. Patient presentation was taught over 4 sessions: 1) a didactic lecture with a patient case, 2) a workshop to demonstrate conducting peer assessment, 3) an in-class discussion with faculty followed by peer assessment of individual patient presentation audio recordings, and 4) a one-on-one patient presentation with faculty or PG-TAs which was also audio-recorded for peer assessment.

An anonymous self-administered survey was conducted to assess students’ attitudes and perception of peer assessment. Patient presentation marks assigned via peer assessment or by faculty or PG-TAs for presentations delivered in Session 4 were also compared to assess students’ accuracy in assessing patient presentations. This study was approved by the University’s Institutional Review Board (Reference Code: S-18-089).
A total of 161 students completed the survey (response rate: 90%). According to the survey findings, students believed peer assessment was a useful way to obtain feedback (93%). Most reported receiving constructive feedback from their peers (77%) that improved their patient presentation skills (67%). While most students trusted their peers to provide honest feedback (90%), they were less confident of their skills in doing so (90% versus 76%, \( p < 0.01 \)).

Qualitative comments suggested that students appreciated peer assessment as a pedagogical strategy that exposes them to different perspectives (e.g. “I learned about other treatment options”). It also allowed students to learn by reflecting on their own mistakes (e.g. “I realised that I missed out on many points for my own patient presentation while I was going through my peer’s presentation”). However, some expressed concerns over the quality of feedback received (e.g. “some peers gave half-hearted feedback that defeated the purpose”).

Patient presentation marks were evaluated for 110 students (62%) who provided informed consent. Total patient presentation marks assigned via peer assessment were lower than the marks awarded by faculty or PG-TAs (61% versus 73%, \( p < 0.01 \)). This difference was explained by students’ stricter assessment of their peers’ presentation styles, as evident from lower marks in this area (59% versus 86%, \( p < 0.01 \)). Marks on therapeutic content of the patient presentation were comparable between peer assessment and faculty or PG-TAs (63% versus 65%, \( p = 0.09 \)).

The results of this study indicate that peer assessment was a useful pedagogical strategy for teaching patient presentation skills and allowed students to learn from their peers with different knowledge and styles. With a standardised assessment rubric, students were consistent with faculty or PG-TAs in assessing the accuracy of therapeutic content but were more critical in assessing subjective areas such as presentation style.

**Keywords**

Peer assessment, patient presentation, pharmacy skills, technology-enhanced

**References**


Bartelme, K. M., & Brown, M. C. (2016). Development and evaluation of students’ skills critiquing clinical documentation. *Innovations in Pharmacy, 7*(1), 12. [https://doi.org/10.24926/iip.v7i1.422](https://doi.org/10.24926/iip.v7i1.422)


Many of the complex problems that we currently face in higher education teaching and learning necessitate an interdisciplinary approach. However, there is still a strong emphasis on discipline-based education in most universities. Therefore, the need to train students to deal effectively with such real-world problems is gaining urgency (Bosch, 2018). Recent calls for a reform of doctoral programmes assert that innovative thinking across interdisciplinary boundaries is a key skill for the 21st century (Bosch & Casadevall, 2017). Furthermore, to make learning more effective, what is also needed is an active learning context that strongly promotes passionate student engagement and genuine meaning-making (Bosch & Casadevall, 2017).

A key feature of the National University of Singapore’s Graduate School for Integrative Sciences and Engineering (NGS) is a curriculum that endeavours to cultivate a keen interest in interdisciplinary research amongst its PhD students, who come from a wide variety of disciplines. This is achieved, for example, through a mandatory course titled “Interface Sciences & Engineering” in which students are exposed to several research areas that involve more than one discipline. However, this course has so far been characterised by didactic instruction and assessment modes that prioritise content knowledge, with relatively less attention paid to the cultivation of interdisciplinarity as a skill. As a result, the learning tends to be more passive than active and the process of interdisciplinarity is not explicitly taught. Moreover, our students’ have a general tendency to be reserved during face-to-face classes, which has the effect of inhibiting collaborative discussions that are otherwise essential to any interdisciplinary activity.

In a previous study, we combined authentic learning elements, interdisciplinary learning theory, and blended learning to redesign only one topic within the above course. In that study we found that students performed better on a single topic conducted in a blended learning mode than on another topic that followed the traditional didactic format. Given this positive outcome, we decided to extend blended learning to other topics to foster interdisciplinarity more effectively and help students achieve the overall learning objectives. We made further modifications to the module by splitting the above topic into two new topics: Introduction to Interdisciplinarity (Topic 1) and Microbiomes and Sustainability (Topic 2).

As a new feature, we designed “thinking questions” based on the “Toolbox Project”, a set of questions designed to elicit the metaphysical and epistemological views of collaborating scientists (Eigenbrode et al., 2007). These questions are meant to provide structure to face-to-face group discussions and encourage student teams to adopt a philosophical approach towards evaluating their projects (O’Rourke & Crowley,
Most students agreed that Topic 1 helped improve their understanding of interdisciplinarity. Our students responded positively to our thinking questions because they believed that the questions were helpful and relevant to them as scientists and engineers. They also claimed that the questions had the added advantage of facilitating their asynchronous forum discussions. The interview responses suggested that these questions helped students think about their own discipline more critically, which is what the questions were designed to do. At the same time, hearing their classmates’ responses also helped them learn more about other disciplinary perspectives, which is crucial in any interdisciplinary collaboration.

The survey and interview responses suggested that the blended learning format in Topic 1 helped prepare students for the online and face-to-face activities of Topic 2. Furthermore, when we analysed their presentation scores for Topic 2, we found that students performed better under blended learning compared to the traditional didactic format. Generally, our students felt that instructor feedback, peer feedback and micro-lectures promoted interdisciplinary thinking. Overall, the findings from both of our studies suggest that blended learning promotes interdisciplinary collaboration in a diverse postgraduate classroom.

Keywords
Blended learning, interdisciplinarity, PhD students, scaffolding, collaboration

References


Why do students perform the way they do? Uncovering the truth with eye-tracking technology

Joseph XU Weijian, KOH Mun Yee Sarah and FOONG Weng Chiong Kelvin*
Faculty of Dentistry
denfwc@nus.edu.sg*

Bloom illustrated that majority of students have the potential to achieve a higher level of learning if instructional practices were tailored to each student (Bloom, 1984). However, with such diversity in student abilities in the classroom, the challenge to address students’ unique learning needs with conventional teaching approaches, though substantial (William, 2011), is surmountable. For example, in developing novices’ X-ray interpretation skills, customising the training that could lead to improved diagnostic performance requires insight into how a novice reads X-rays. Such insight was gleaned from a collaborative study between NUS Dentistry (DEN), NUSMED Diagnostic Radiology (RAD), and Nanyang Polytechnic’s (NYP) Dental Hygiene and Therapy programme. Funded by the Ministry of Education’s Tertiary Education Research Fund (MOE TRF), the programmatic research study aims to leverage on eye-tracking technology to (i) investigate the discrepancy in students’ performance in interpreting X-rays, and (ii) to enhance the inclusivity of teaching practices by providing formative feedback customised to each student. This paper also seeks to surface the challenges faced by the research team during implementation.

Using eye-tracking technology as an objective measure to track the students’ eye-gaze and fixations, instructors are now able to gain insights into each students’ approach to reading an X-ray. This adds a new dimension to the kind of feedback that instructors can provide, allowing them to better address the strengths and shortcomings of each student. According to numerous studies, feedback is recognised as the most influential method of learning as it not only indicates gaps between desired and actual performance of a task, it also allows for correction of approaches and strategies adopted to accomplish that task (Hattie & Timperley, 2007; Shute, 2008). This study thus seeks to investigate the effectiveness of feedback, enhanced with eye-gaze and fixation data, in increasing the accuracy and efficiency of X-ray interpretation in students.

For studies conducted with DEN and RAD, participants were divided into senior and junior groups. Their performance was monitored over multiple sets of X-ray interpretation exercises. Answers were given to all participants after each set, with the junior group receiving additional formative feedback. Preliminary results showed that formative feedback did not lead to significant improvements in performance in interpreting X-rays for the junior groups in DEN and RAD. In contrast, senior groups who did not receive formative feedback reported significant improvements in performance. While the results seem to present a different picture regarding the effectiveness of formative feedback, such an instructional approach should not be immediately dismissed as having fallen short. It is crucial to reflect upon the experimental design of the research and analysis of the results to uncover any factors that might have confounded the outcome.
Inherent in any collaborative study were operational challenges that accompanied the execution of the project. Some challenges common to typical research were that of participant recruitment, experiment scheduling, obtaining approval from the institutional review board, and financial constraints. With the experimental design adopted, the team faced some challenges unique to the research. For example, the team faced difficulties obtaining input from busy instructors required for the construction of feedback. There were also hardware limitations such as the eye-tracker providing differing qualities of data (i.e. percentage eye-gaze data captured, calibration accuracy etc.) for participants with different physical traits.

The eye-tracking findings from this study is an example that fellow educators can reflect upon when conducting future studies that aim to introduce more inclusive practices in teaching to cater to diverse student learning needs. In implementing the collaborative study, the research team also learnt that while it is crucial to control for confounding factors to ensure a robust research design, it is not possible to predict the types of challenges or hiccups that might surface during the study. Documenting the challenges and how these were addressed provides a record of the team’s self-reflection process, which is essential to the success of a collaborative research endeavour.

Keywords
Formative feedback, eye-tracking, diagnostic radiology, technology, X-ray interpretation

References


Design charrette pedagogy in flipped classroom to enable creative exploration outside design studio: A case of Environmental Systems module in architecture education

Noopur JOSHI* and LAU Siu-Kit
Department of Architecture, School of Design and Environment
akinvj@nus.edu.sg*

In the current Architecture programme, traditional lectures disseminate domain-specific knowledge and students are expected to integrate it into their design studios (Nicol & Pilling, 2005). Non-studio modules focus on developing conceptual understanding, while the studio requires students to engage in creative decision-making. One common challenge students face in design studios is that they struggle to apply the domain knowledge to creative studio tasks and thus, the knowledge remains limited to examinations. In addition, studios are laden with the responsibility of integrating multiple domain knowledge into a single design inquiry that makes it difficult for students to experiment with ideas relating to each domain entirely, in this case, ‘Environmental Systems’.

The flipped classroom, a blend of e-learning and face-to-face teaching (Garrison & Kanuka, 2004), with an appropriate teaching pedagogy can transform the way domain modules are taught in the creative architecture environment (Elrayies, 2017). The pedagogy usually applied in the studio, learning-by-doing (Ghaziani, Montazami, & Bufton, 2013), whereby students construct knowledge by engaging in activities to make sense of new information (King, 1993), can be applied to non-studio modules to allow them to practice knowledge application and creative exploration in simple design tasks such as the design charrette (Walker Jason, 2008) during the face-to-face portion of the domain-specific module.

Charrette is a learning activity in which students work and discuss in groups to find solutions to a time-based design problem. The design process is an interactive cycle of “design-analyse-evaluate-redesign”, where students critically analyse their designs based on knowledge rationale and evaluate their work against priori-criteria to make improvements. This process of critiquing, known as design crit, is essential in creative decision-making (Hokanson, 2012).

This presentation seeks to solicit feedback on the design of a study the authors intend to conduct in Semester 2 of AY 2019/20 to measure the impact of ‘design-charrette and crit’ pedagogy in flipped classrooms on students’ ability to creatively design environmental systems. A quasi-experimental mixed method study will be conducted with Year 3 undergraduate architecture students taking the module AR3721 “Environmental Systems and Modelling”. Previous Year 3 students will form the historic control group against which the results
of creativity will be tested. For the treatment using the flipped classroom, video lectures will be used to disseminate the subject knowledge prior to the design charrette. In class, students will work in groups to actively explore creative solutions to predetermined design problems. At the end of each session, students will engage in group crit to evaluate peer work. Students’ creativity will be measured on a rubric developed for the study that will measure the creative process and product. Interviews at the end of the semester will be conducted to triangulate the findings. Students will be able to try radical ideas practically under the tutor’s guidance, and the availability of such support will increase their confidence to apply the same in their design studio projects.

It is anticipated that the findings of this study will shed light on the extent to which the ‘design charrette’ pedagogy in flipped classroom model would improve students’ ability to creatively design building systems; based on the constructivist theory of learning. This study features a robust educational model that can be applied to other domain-specific modules to foster sustainable design in the architecture curriculum by promoting integrated and innovative building system design, nurturing future leaders in architecture and construction, and reinforcing the S.T.E.A.M\(^1\) educational model (Ng, 2018).

Endnote

1. S.T.E.A.M. is a new educational model proposed by the Ministry to Education to include Arts as a core faculty into the existing S.T.E.M. (Science, Technology, Engineering and Mathematics) model. Art is added to the curriculum to draw on design principles and to encourage creative solutions.

Keywords

Design education, flipped classroom, design charrette, creativity, architecture
References


Using a social annotation tool in the Ideas and Exposition Module (IEM) classroom

Marissa Kwan Lin E
Centre for English Language Communications
elcmari@nus.edu.sg

The inclusive education pilot study described here aims to examine the practicality and usefulness of a social annotation (SA) tool, Hypothes.is, in the context of an Ideas and Exposition Module (IEM). Hypothes.is allows for annotations to be made on a webpage by users via an installed application (app) on a computer’s web browser. Using the Hypothes.is platform thus enables groups of readers and writers to “proofread, provide corrective feedback, peer review, mark key points and assess and measure knowledge and application abilities” (Lebow, Lick, & Hartman, 2009; as cited in Mendenhall & Johnson, 2010, p. 264). This study is situated within the context of inclusive education in higher education (see Moriña, 2017), and is based on “Checkpoint 5.1 Use Multiple Media for Communication” from the Universal Design for Learning (UDL) framework (CAST, 2018) that encourages the use of multiple media.

The rationale for this study stems from an oft-cited issue by students in the IEM programme about how their coming from different faculties, with little to no exposure to the academic content area relevant to the IEM, can pose challenges for them. The specific academic content in this type of module can be considered “threshold concepts” (Meyer & Land, 2006), since this content is challenging yet necessary for students to engage effectively with both assigned academic journal articles (written by academics for an academic audience) and in-depth articles from non-academic sources (written by expert laypersons for an educated non-academic audience). Thus, SA tools like Hypothes.is, with their potential to leverage on learner-centredness, knowledge-centredness, informal assessment and community centredness (Mendenhall & Johnson, 2010; Novak, Razzouk & Johnson, 2012), can potentially help students engage with and better understand the specific academic content needed in an IEM.

The particular context of this study is the IEM UTW1001A “Identities and Ideas in Market-Driven Societies”. It focuses on using neoliberalism and its associated concepts as specific academic content to teach general skills in academic expository writing, adopting a Content and Language Integrated Learning (CLIL) approach (Marsh, 2002). An initial pre-course survey indicated that most respondents were unfamiliar with the module content. Quite a few also expressed concern about whether they could grapple with the content required by the module.

Students utilised Hypothes.is during class time over a period of two weeks, with tutor supervision, to answer selected questions in their tutorial handouts. Based on the annotations obtained from Hypothes.is, it was observed that students were engaging with the web texts assigned in a variety of ways. These included
answering the assigned tutorial questions and replies to annotations made by other students and the tutor (see Figure 1 below). In addition, student artefacts such as the mind-maps they produced about neoliberalism and concepts related to neoliberalism following this two-week period showed evidence of their understanding of, and engagement with the specific academic content required for the module. Furthermore, textual analysis of UTW1001A’s final assignments showed that despite belonging to different faculties, students had utilised the threshold concepts relevant to the module appropriately and constructively. A follow-up survey conducted soon after the intervention also showed a significantly positive response towards the utilisation of Hypothes.is.

Therefore, the findings of this pilot study indicate that the employment of SA tools can potentially serve as a complementary teaching and learning tool, whereby digital media can be used together with other types of learning material, media and methods since it can potentially help students from diverse disciplinary backgrounds reach a required level of understanding of threshold concepts in an IEM 1000 module. Moreover, there is the added advantage of extended applicability for students, since the SA tool can help facilitate collaboration, peer learning and active engagement with assigned readings in other modules.

Figure 1. Student and tutor annotations
Keywords

Social annotation tools, threshold concepts, Universal Design for Learning, peer learning, active learning

References


Assessing learning outcomes of embedding leadership communication skills in an information systems leadership course

OH Lih Bin
Department of Information Systems and Analytics, School of Computing
ohlb@nus.edu.sg

Chitra SABAPATHY
Centre for English Language Communications
elccs@nus.edu.sg

This disruptive age calls for new ways to teach and learn leadership skills. While some institutes of higher learning have responded to this call by offering either leadership content or leadership communication courses, or focusing more on one discipline than the other (e.g., Yong & Ashman, 2019), a more holistic and future-proof approach will better prepare current learners for future leadership roles. This research discusses the course design process and impact of a collaborative effort between two disciplines to embed leadership content with leadership communication skills and addresses an increasing call in recent years to embed communication skills in the curriculum (Johnson, Veitch, & Dewiyanti, 2015). This newly developed, compulsory core module called IS3103 “Information Systems Leadership and Communication” is targeted at business analytics, information systems (IS), and information security undergraduates from the School of Computing (SoC). Instructors from both SoC and the Centre for English Language Communication (CELC) co-teach the module. The course content integrates traditional leadership topics with emerging IS leadership issues and challenges. Students learn through case studies and experiential leadership activities in lectures and tutorial sessions offered by SoC; while CELC conducts recitation sessions to hone their leadership communication skills. A major challenge to coordinating the communicative aspect of this module was the dearth of research on IS leadership communication despite the pervasive need for IS leaders in this disruptive age. Aspects of Fairhurst and Connaughton’s (2014) leadership communication value commitments were selected and three broad strands of influential, strategic and change communication skills were systematically embedded into IS content using Dewey’s social constructivist approaches with “wicked” problems and contextualised workplace scenarios (Ismail & Sabapathy, 2016). To further increase the integration efforts between leadership content and communication, the main group assignment project, set in a senior leadership decision-making context, was deliberately designed. This project required students to be able to apply both domains learned in class, and present the outcome in written and oral mediums to mixed target audiences.

The reflection journal, regarded as an effective pedagogical approach in the teaching of leadership (Roberts, 2008), was also used as an end-of-course assignment in this module. We used data from four semesters of teaching and module feedback reports, and one semester of students’ reflection essays to identify learning outcomes of the course. We performed content analysis of the student feedback and their
reflections on course learning. Findings suggest that respondents found the module useful and there was transference of communication and content skills to academic and future domains. Some students suggest that the course was intense and they found it challenging to conceptualise the integration between the two disciplines. These results inform efforts to further streamline and refine this module and also shed light on important lessons and implications for similar collaborative efforts that attempt to develop students' professional competence through the intertwining of soft skills training with domain knowledge.

Keywords
Leadership, communication skills, information systems, professional competence

References


I have always been a strong proponent of technology-enhanced learning (TEL) and believe that the appropriate and relevant use of technology can significantly enhance long-term student learning and thus help educators attain both student- and module-related learning outcomes. TEL can also promote the efficiency of classroom lectures and help student gain a better understanding of the lecture/tutorial topics being discussed. I have employed TEL strategies to enhance the teaching-learning process in my classes. In this presentation, I will describe the TEL strategies I have adopted and demonstrate their effects on student learning. I will describe three strategies, namely,

1. **Using 3D printed medical device prototypes to promote tactile and visual learning.** This strategy was implemented through the robust development of 3D printed medical devices and using them as a means to communicate and explain critical yet fundamental engineering concepts (Pikkarainen, Salminen, & Piili, 2017; Felder, & Silverman, 1988; Garas, Vaccarezza, Newland, McVay-Doornbusch, & Hasani, 2018; Lara-Prieto, Bravo-Quirino, Rivera-Campa, & Gutiérrez-Arredondo, 2015; Pandey & Zimitat, 2007).

2. **Creating and integrating scenario-based learning strategies for long-term student learning.** Here I create scripts and plays which encompass various ethical contexts and scenarios that our students may face in their professional careers. Some fun and humour has been added to the scenarios and also during the classroom discussions, to promote active learning and make it enjoyable for students (Beaton, 2009; Cheesman, 2006; DeNeve & Heppner, 1997; Tay & Musib, 2017; Musib, 2014; Musib, 2019a; Musib, 2019b).

3. **Using artificial intelligence and virtual reality (AI/VR) in lectures to promote student learning.** In this strategy, I used AI/VR to explain fundamental engineering concepts which are otherwise difficult to accomplish through traditional lectures and Powerpoint slides, particular if the concepts involve 3D objects/medical devices (Musib et al., 2017).

These are my reflections on the implementation of various TEL strategies in my teaching and I will share both qualitative and quantitative data as evidence of their effectiveness in enhancing the student learning process.

The evidence for effectiveness of the individual TEL strategies adopted were collected through various means. They included student interviews (conducted many months following the conclusion of the module to ensure they could still remember and relate to their past learning), focus group discussions, student feedback.
exercises (comprehensive feedback forms were developed consisting of both qualitative and quantitative questions for each of the strategies adopted), as well as my own reflections. The results were very encouraging, with majority of students indicating that these technologies enhanced their learning and level of understanding of the module content.

Acknowledgements
Funding was provided through CDTL, the NUS Teaching Enhancement Grant (TEG), and the Faculty of Engineering (FoE) Technology Enhanced Learning (TEL) grants.

Keywords
Technology enhanced learning (TEL), scenario-based learning (SBL), long-term learning (LTL), Artificial intelligence/virtual reality (AI/VR), tactile and visual learning (TVL)

References


Smart devices, smart learning: Winning students’ attention in large classes

CHIAN Siau Chen
Department of Civil and Environmental Engineering, Faculty of Engineering
sc.chian@nus.edu.sg

The traditional mode of lecture delivery has been heavily criticised for being a one-way form of communication that does not involve student participation. This is an increasingly pressing problem nowadays as students have more distractions and are less attentive. This has led to university educators incorporating visuals such as pictures and videos into their teaching materials to capture students’ attention and sustain levels of interest in the subject matter. The most recent attempts were aimed at encouraging higher levels of student participation in small group classes. For large classes, such two-way engagement is limited and the conventional lecture style, where the lecturer stands in front of the theatre and recites information, is still prevalent on most campuses. In that case, should we do away with lectures completely?

Technology enhanced learning can potentially overcome the issues cited earlier and open up high quality learning experiences for students and enhance the effectiveness of their learning. This is in line with the vision put forth by the Global Learning Council (GLC) in 2016 (NUS News, 2016). Similar initiatives were also introduced in other higher education institutions such as MIT (MIT News, 2016). Many technology-enabled learning methods claim to do wonders by adopting videos and simulators, but most tackle only the mode of delivery. Deploying technology in this way will not have the desired impact on learning unless teachers adopt and adapt to newer pedagogical practices (Bandyopadhyay, 2013). A more effective use of technology to enhance learning should be through the “Smart” approach. The “Smart” use of technology in learning should extend beyond simply the mode of delivery and focus instead on raising students’ levels of understanding, allowing them to provide feedback and thereafter tailoring the module content and pace of teaching to suit their learning needs. In this way, learning is more effective and students have a deeper and more lasting impression of the taught content. An initiative was hence carried out to capitalise on technology to enhance such learning opportunities for students. This initiative was also used to address the shortcomings of large lectures of 100 students or more in the form of interactive quiz games via the online platform Kahoot (Kahoot, 2016).

In these interactive quiz games, students would be asked to read the lecture notes before attending the lectures. During the lecture, students have to answer some questions via Kahoot. They can submit their answers during the lecture using their mobile devices (smartphone, tablet or laptop). At the end of the lecture, the same quiz questions would be given to students again via Kahoot to verify whether there have been improvements in their levels of understanding of the lecture materials. Following the quiz, statistics of students' attempts would be shown after each question in the form of bar charts to encourage immediate feedback.
With the assessment statistics, the lecturer can provide some degree of customised explanation to the particular lecture class. If most students in that lecture class gave the wrong answer to a particular question, the lecturer has an opportunity to address the error, either by rephrasing or reinforcing the relevant concepts more thoroughly. Finally, an e-survey would be provided at the end of the quiz so students can air their positive and negative responses to the quiz questions and lecture materials covered. This would provide the lecturer with further feedback for the improvement of lecture materials and the mode of lecture delivery. In some lectures, discussion topics are provided via Kahoot as checkpoints for students to reinforce and clarify their learning through discussions during the lectures with their friends sitting around them.

From the feedback collected following each quiz and at the end of the module, it is evident that many students enjoyed the online quizzes and felt that they were good supplements to the key concepts taught. In addition, these quizzes allow students to immediately apply what they have learnt during the lectures. When students experience the satisfaction of getting the correct answers to key module concepts (which were highlighted as questions), these concepts can potentially be retained as longer term memory, and they would eventually be able to connect the topics together and gain a broader appreciation of the module. These would be in line with the objectives for introducing the online quizzes as part of the lecture activities. Students gain more interest in participating in lectures and they can verify their understanding of lecture materials. Meanwhile, the lecturer is able to provide immediate feedback and correct their misunderstanding of key concepts. Overall, students’ opinions of the online quizzes were largely positive, with a larger percentage giving “Excellent” and “Good” opinions of this smart learning initiative, as shown in Figure 1.
Figure 1. Survey responses of students of AY2014/15 (without smart learning), and AY2015/16 and AY2016/17 (with smart learning).

Keywords
Personal devices; technology; quiz; learning experience; self-efficacy

References


Project-centric approach and student’s metacognition in creating an authentic learning environment to enhance student’s engagement in teaching bioinstrumentation—A case study

James Chen Yong KAH
Department of Biomedical Engineering, Faculty of Engineering
biekahj@nus.edu.sg

BN2403 “Fundamentals of Biosignals and Bioinstrumentation” is a core module taught to a large class of about 150 second year biomedical engineering undergraduates. This module teaches fundamental mathematical concepts behind signal processing, bioinstrumentation, electric circuit analysis, biosensors, bioamplifiers, and their related applications to biomedical device design. The traditional way of teaching this module, with its heavy mathematical focus, creates an apparent dissonance between solving mathematical equations and real-world applications using electronics, as many students are unable to relate the concepts learnt to real-world applications in biosignal processing.

To enhance students’ engagement, we designed a more authentic learning environment for BN2403, adopting a project-centric approach to bridge the learning divide students experience between mathematical concepts and real-world implementations of biosignal processing. We also incorporated metacognition as a tool to foster deep learning as part of the authentic assessment in the design-based project. Here, students were given an opportunity to reflect and self-assess their learning through the project development process. An authentic learning environment is especially important in engineering education to produce “work-ready” graduates as it creates a real-world work scenario for students to better appreciate their learning through the process of developing and evaluating a product.

This project-centric approach involves designing lectures and tutorials around the concepts that are required to implement the design project successfully. Here, the lectures and tutorials are used to scaffold students’ learning towards solving an actual problem from the project (Figure 1).

Figure 1. Project-centric learning framework in BN2403.
Here, the students used the Arduino microcontroller to process their collected electrocardiogram (ECG) signals as an authentic activity. To better guide the students, they were given four assignments of increasing complexity at various milestones in the semester. Each assignment contained instructions to guide students towards completing a certain milestone in their project. The assignments were progressive as the outcome of each assignment was used to accomplish the subsequent one.

The supporting lectures covered not just the fundamental mathematical understanding of these operations, which is the conventional teaching approach, but also the coding to convert the mathematical algorithms into a programme for the microcontroller to perform the ECG signal processing task. Throughout this project, students worked in groups, similar to real-world project teams, and did a final report and oral presentation of their work, similar to what engineers would do in a product development setting. The ability of their codes to process the ECG signals according to specifications provided an authentic assessment of their learning outcomes.

Based on the student’s survey findings, examination results and focus group interviews, we concluded that this case study on adopting a project-centric approach towards creating an authentic learning environment helped enhance student’s levels of engagement in BN2403. The authentic learning environment in which students worked in groups to develop a prototype device allowed the theoretical mathematical concepts taught in lectures to be translated into practical applications and solutions. The ability of the project to allow students to put into practice what they learnt not only resulted in improvements in their engagement in the module content, but also enhanced their interest and perception of the module.

Furthermore, the triangulation of collated data involving assessing the quality of the student’s prototypes, their weekly short reflections on the development process, and end-of-project meta learning reflections, as well as findings from the Motivated Strategies for Learning Questionnaire (MSLQ) survey revealed a positive impact of student’s metacognition on their learning and assessment, since they were able to produce prototypes with features that were not taught to them, and the MSLQ results showed improvements in the students’ levels of motivation in learning at the end of the course. The students’ reflections also demonstrated that through the project, they now know a little more about themselves and their respective learning processes.

**Keywords**

Authentic learning; authentic assessment; metacognition; Motivated Strategies for Learning Questionnaire (MSLQ); design project.
In higher education academic writing, having a voice is necessary because it provides both instructors of content and communication the basis for assessing learners’ thought processes and reasoning skills. The use of voice involves more than just representing ideas from relevant sources; it also affects the way sources are used to support or put forward a point. Taking on a practitioner research approach, we present three interrelated components which may serve as evidence indicative of students’ development of voice in academic writing, which are content, language, and organisation. The interrelationship may be represented through content that is aligned towards a particular view, with the alignment aided by accurate register and coherent organisation. These components are comparable to the tenets of a social constructivist approach for academic writing, which consist of sociocultural, writer identity, and argumentative principles (McKinley, 2015).

Our presentation is based on the Intensive English course offered to students in the Faculty of Law at NUS, who learned English as a foreign language. In this course, academic writing support is provided through the examination of academic text features. These texts are also discussed through critical thinking instruction, namely the dialectical thinking approach, which seeks to be a “cognitive tool for understanding complex issues” (Tanaka & Gilliland, 2017, p. 671). This process requires writers to consider their “social role, power, and the appropriate use of language (Tribble, 1996, pp. 12-14) and the objective of this course goes beyond the production of grammatically accurate text—it seeks to raise awareness of the nature of writing as a communicative event in order to form a voice. The academic texts come from the topics of financial technology and immigration, under the notion of disruption in society.

Not long after the course started, it was discovered that these students do possess the ability to critically examine texts; however, they found it challenging to surface a critical perspective to be able to effectively express their voice because of the lack of such awareness and experiences. Ramanathan and Atkinson (1999) argue that the notion of having an academic voice may be a western construct which some of these learners are uncomfortable with as it goes against their sociocultural norms that value consensus and discourages discord.

With these challenges, the students’ voice may be impeded. A study by Spalding, Wang, and Hu (2009) found that it was possible to help these learners develop a voice in their writing by providing students with opportunities to discover their voice by working on meaningful tasks. Bearing these challenges in mind, and
through personal conferencing, we utilised a social constructivist approach, where we sought to help students understand (1) their own sociocultural underpinnings; (2) their expanded identities as writers in a context where the individual's ability to (re)construct knowledge is valued; and (3) instructed students on the inclusion of argumentative writing style pertinent to their discipline.

To track students’ development of an academic voice, a series of surveys consisting of perceptive items and those requiring open-ended responses was administered. Findings (n=19) indicate that the activities encouraged participation, seen through students’ perceptions of ample opportunities to share thoughts, and to evaluate their own views (both at 94.7%). This positive disposition is supported by students’ qualitative responses, expressing a shift from factual reporting to more critical and analytical writing directed by their voice. This helped them be more relevant and coherent in their writing tasks, and more importantly, to be heard.

Keywords
Academic writing; student voice; critical thinking

References


Clickers to scaffold higher cognitive thinking in traditional lecture class: An evidence-based study of architecture students

LAU Siu-Kit* and Noopur JOSHI
Department of Architecture, School of Design & Environment
slau@nus.edu.sg*

The Architecture programme is structured around the design studio, and includes other subject-specific courses as supplemental programmes that help students prepare for the studio. Students spend most of their time in the design studio in small cohorts where they engage in substantial interaction with their peers and teachers. On the other hand, preparatory courses that develop technical knowledge and skills are taught in in large lectures in the traditional didactic format, with a high student-teacher ratio that impedes such a synergy. Inadequate levels of engagement and interaction lead to diminished motivation and eventually, lower student learning outcomes. ‘Pause and Recall’ is a powerful tool to retain attention, boost motivation, and improve performance in class (Ruhl, Hughes, & Schloss, 1987). ‘Pause and Recall’ suggests pausing intermittently in a long lecture to assimilate and recall the taught content. It is, however, challenging to execute it efficiently in a large class. Also, undergraduate education aims to promote higher levels of cognitive thinking and not merely to recall subject content. Clickers are known to be an effective classroom response system (White, Syncox, & Alters, 2011) that can be used to facilitate interaction (Bachman & Bachman, 2011) during portions of the lecture sequence where there is a pause, without disrupting the lecture’s sequential flow. Clickers, when coupled with an instructional strategy such as ‘prompts’ that promote the application of concepts, can promote metacognition (Brady, Seli, & Rosenthal, 2013). A prompt is an instructional technique which involves using questions with one or multiple correct answers to prompt in-class discussions (Burnstein & Lederman, 2001). Metacognition affects students’ achievement goals (Vrugt & Oort, 2008) and can lead to improved academic performance. This project aimed to increase students’ levels of engagement with the content, tutor, and among peers in a traditional lecture setting, and consequently bring about higher cognitive learning outcomes. The objective was to examine the effectiveness of clickers to implement ‘Pause and Recall’ in a large class and its impact on students’ approach to learning and students’ academic performance at various cognitive levels. A mixed-method quasi-experimental study among Year 3 undergraduate students was conducted. Students’ approach to learning (using Biggs’ R-SPQ-2F questionnaire) was measured before and after the instruction. Students’ perception of using clickers and learning outcomes as per Bloom’s Taxonomy was measured using a self-developed survey and quiz respectively at the end of the semester. Qualitative analysis of students’ learning experiences was done through interviews using the random sampling method. Results suggested that students largely attributed increased engagement (86%), improved understanding of content (78%), and motivation (75%) to the use of clickers. Statistical non-parametric tests showed a strong correlation between positive attitudes towards clickers and higher levels of cognitive performance ($rs = 0.246, p = 0.029$). Interviews revealed that students found the lecture sessions engaging and were eager to learn the content in greater depth. The timing and design of ‘clicker’ activities steered
the discussions that guided students to think deeper and led to significantly improved student learning outcomes at higher cognitive levels. To improve higher-order cognitive learning when engagement is a challenge in large classes can be an onerous task. However, with careful curriculum design and the help of technology, it is possible to inculcate and enhance higher-order thinking among students in large classes.

Keywords
Pause and recall, classroom response system, interactive learning environments, student learning outcome, approach to learning

References


Not in class: The seats left empty by high-ability students from low-income backgrounds

Eqtoffaaq Saddam Hussain Bin GULAM HUSSAIN
Yale-NUS College
saddam.hussain@u.yale-nus.edu.sg

As an ethnic minority undergraduate, no one questions how I came to regard tertiary education as valuable to the progress of underrepresented minority groups. One might suppose that the cultural and financial benefits of tertiary education appear as self-evident to university students who identify with underrepresented minority groups on campus. This assumption also omits any indication of how minority groups arrived at this perception of tertiary education in the first place. Ironically, the negative implications of this assumption are most insidious during conversations about diversity and inclusivity in tertiary education. In a landmark study on the influence of social class over the university application behaviour of students from differing socioeconomic backgrounds, Hoxby and Avery (2013) found that 53% of low-income students whose grades qualify them for Harvard inevitably made the decision to forgo tertiary education completely. This case illustrates how academia’s conversation about promoting diversity and inclusivity all too often overlooks the influence of social class on the perception of tertiary education. Smith, Pender, and Howell (2013) have come to identify this phenomenon as the “academic undermatch”.

By conducting a qualitative study on the college application process of low-income students, I hope to illustrate several factors that could be utilised to circumvent the adverse effects of social class on the perception of tertiary education, and by extension, the formation of academic aspirations. The majority of literature on inequality in education outlines diversity and inclusivity as traits that can be gauged by changes in student body demographics, or by redefining curriculum design. I ultimately want this paper to ignite conversations about how universities can coordinate with pre-university institutions to better address how social class might distort tertiary institution as a viable avenue for social mobility. From a policymaker’s perspective, encouraging high-ability, low-income students to apply to selective colleges could break the intergenerational transmission of poverty and decrease income disparity (Hoxby & Avery, 2013). This is also important because vast pools of resources are constantly invested to help low-income students perform on the same level as their peers who come from higher income households (Lor, 2018).

As a social institution, tertiary education remains embedded within deeply rooted beliefs that are themselves connected to social norms like social class. By reinforcing certain beliefs, tertiary education might also reaffirm the framework of social class that constrains the academic aspirations of low-income students. Factors such as the availability and quality of information are themselves the result of the influence of social class on the acquisition and internalisation of information about universities. Bourdieu’s (1999) concept of habitus comes to mind, in that decisions associated with income-typical behaviour should be seen as rational...
decisions relative to the constraints and conveniences of students from low-income backgrounds. Conversely, the choice to pursue tertiary education might be influenced by cultural expectations. High-income individuals are more likely to grow up in social and cultural environments that perceive tertiary education as the only appropriate choice after the completion of secondary education.

By examining Bourdieu and Passeron’s (1977) view of the curriculum as a ‘cultural arbitrary’ that only serves to propagate unequal power relations, I identify all forms of conventional curriculum-building as implicit in recreating unequal power dynamics. However, I also account for socio constructivism’s prejudices against curriculum design by envisioning an education system built by those without power. At this juncture, I revisit Michael Young’s (2013) notion of powerful knowledge. Powerful knowledge, as opposed to education, could be the theoretical basis from which we inspire minority communities to empower themselves. In terms of long-term planning, I envision the future of Singapore’s minority communities through the organisational failures of a robust education system in providing vulnerable communities with powerful knowledge. I will close by elaborating on how Madrasahs, as faith-based schools with their own academic milieu, can adopt the theoretical basis of powerful knowledge to defuse unequal power relations within their existing curriculum.

References


Pecha Kucha Presentations
Technology advancement and digitisation has transformed the learning and teaching environment in institutions of higher learning around the world (Gehlen-Baum & Weinberger, 2014). Technology is often viewed as a double-edged sword in education, potentially causing disruptions to traditional learning and teaching models, but at the same time providing opportunities for new learning and teaching avenues. In recent years, lecture capture or lecture recording has been widely adapted by institutions of higher learning (Leadbeater, Shuttleworth, Couperthwaite, & Nightingale, 2013) to provide students with supplementary resources to learn and revise independently. Lecture capture has been found to provide a platform for inclusive learning, allowing students with different learning styles and abilities the opportunity to improve their learning (Nightingale, Anderson, Onens, Fazil, & Davies, 2019).

For science and engineering courses, the lectures often include the presentation of notes and information in PowerPoint, accompanied by derivations or explanations of equations or concepts by the lecturer with writings on the blackboard, whiteboard, visualiser or directly on PowerPoint slides. One common feedback from students regarding the lecture capture system is that often, part of the lecturers’ writing and derivations on the whiteboard may not be captured clearly together with the recording. A consequence is that it affects the quality of the student’s learning experience from the recorded lecture. There is a need to address this common problem and there are in fact several technologies and avenues for digitisation and sharing of materials developed during lectures which can improve the situation.

In this presentation, I share my experiences on a simple-to-use tool (Whitelines®) which can improve the teaching and learning experiences for a typical science and engineering lecture which uses handwritten notes and derivations extensively. Whitelines® allows handwritten notes to be converted to high quality digital material in a simple and efficient way. This is possible via an accompanying mobile app that is designed to be used for the paper, and is free for download onto any mobile device. Using Whitelines® on a visualiser during lectures allow students to grasp the lecture content presented more efficiently. The handwritten notes can be converted to a high quality pdf format and shared almost instantaneously with students via the mobile app installed on the lecturer’s mobile device, as illustrated in Figure 1. This will support and enhance student’s learning outside of the classroom when supplemented with a video recording of that lecture. In terms of student feedback on the use of Whitelines® as a supplementary material to complement their online learning from lecture recording, it was found to be overall positive with 93.2% indicating that they agreed or strongly agreed that the tool was effective in helping them gain a better understanding of the subject (Figure 2).
Whitelines® is one of many tools that can be used to improve student’s learning experience and performance from lecture capture. The feedback from students who took the module indicated that it had helped to enhance their learning. Free text comments from the module feedback included, “This is very helpful for further understanding and to visualize the equations”, and “The scanned workings which allows us to refer back, very informative”. From the lecturer’s perspective, students’ overall learning experience can be further improved and supported via the use of the learning management system as a platform to communicate module-related information and materials. The challenges and desired functionalities of the learning management system to support student learning from the module-related resources made available to them will be discussed further in this presentation.
Keywords
Digitisation, Whitelines®, lecture notes, lecture capture, mobile app

References


Driven by the rapid development of information and communication technologies (ICTs), a new educational landscape has emerged to respond to the new generation of learners who grew up with such technologies—the digital natives (Prensky, 2001). In this new learning landscape, active student engagement is replacing passive information transmission, cultivation of digital literacies is receiving more attention, and integration of ICTs to enhance student learning is increasingly acknowledged and encouraged (International Society for Technology in Education, 2002). From Massive Open Online Courses (MOOCs) to flipped or blended classrooms, educators and learners are presented with a plethora of options as well as challenges. On one hand, education seems to be more accessible and learning more engaging (Plump & LaRosa, 2017; Shon & Smith, 2011; Tessier, 2013). On the other hand, the pertinent low completion rate of MOOCs despite their popularity (Gütl, Rizzardini, Chang, & Morales, 2014) and educators’ varied opinions about ICT integration (Li, 2018; Trentin & Wheeler, 2009; Vahedi, Zanella, & Want, 2019) pose a noteworthy question about how to create a technology-enhanced classroom that can create a meaningful learning experience for students.

Against this backdrop, the Community of Inquiry (CoI) framework (Garrison, Anderson, & Archer, 1999; Garrison, 2011) provides illuminating guidance to the effective integration of ICTs in both online and blended learning (Garrison & Vaughan, 2008). According to the CoI framework, a sustainable community of learners requires the presence of three dimensions: (1) teaching presence, (2) social presence, and (3) cognitive presence. The intersection between these three dimensions is where meaningful learning experience takes place. In practice, teaching presence is achieved when learning activities are well-designed and well-facilitated; social presence is achieved when learners are comfortable to be who they are and engage in open and trusting communication, and lastly cognitive presence is achieved when learners are able to “construct meaning through sustained communication” (Garrison, Anderson, & Archer, 1999, p. 89).

This PechaKucha presentation charts an attempt to leverage the CoI framework to create a deep and meaningful learning experience for the students in the module FAS1102 “Public Writing and Communication”. As a flipped module, FAS1102 embraces a constructivist pedagogical perspective that views students as “active sense makers who seek to build coherent and organized knowledge” (Mayer, 2004, p. 14). The students have the autonomy to select a social issue in Singapore they are passionate about, embark on a group project to dissect the issue, and identify gaps in the existing discourse about the issue they could address with their writing and presentation. To scaffold their learning process, a range of collaborative activities such as a group writing exercise and peer reviews are implemented. Instrumental to these activities are collaborative tools such as Microsoft Teams and Padlet, among others. Apart from the observable active
student engagement, it is noted that with effective integration of ICTs, the CoI framework could potentially cultivate a responsible and inclusive learning community.

**Keywords**
Community of Inquiry, ICTs in higher education, collaborative and inclusive learning community

**References**


Li, L. (2018). Integrating technology in ESP: Pedagogical principles and practice. In R. Muñoz & L. L. Taillefer (Eds.), *Integrating Information and Communication Technologies in English for Specific Purposes*. Springer, Cham. [https://doi.org/10.1007/978-3-319-68926-5_2](https://doi.org/10.1007/978-3-319-68926-5_2)


Considerations for inclusive education in online curriculum design

LAM Wanli, Aileen
Centre for English Language Communications
elclwa@nus.edu.sg

The literature on massive open online courses (MOOCs) often focuses on completion rates of online courses (Jordan, 2015). Many studies have looked into the reasons behind low completion rates so that educators can consider ways to encourage participants to interact with all the online content and activities.

However, this PechaKucha aims to challenge this notion of completion in fully online courses to cater to a diverse range of learners who (1) may choose to interact only with some parts of the course, and learners who (2) may need extra pre-course resources as they do not have the relevant content knowledge or cognitive ability to deal with the main course syllabus. This presentation argues that completion rates should be dependent on the materials and activities that a learner sets out to finish at the beginning of the course instead of a completion of all the course materials.

Inclusive education takes into account the needs of a diverse range of students with different ethnicities, religions, gender, and abilities such as those who are underachieving or less able academically (Ainscow, 2005; Mitler, 2012). This PechaKucha argues for inclusive online education, specifically for learners with differing interests, experiences, training and abilities. Hence, online courses such as MOOCs should provide optional resources to support those without the relevant content knowledge due to their experiences and training, as well as those with lower cognitive ability so that they are equipped to deal with the main course syllabus. This allows learners to pursue their interest and regulate their own learning successfully (Littlejohn, Hood, Milligan, & Mustain, 2016). Since optional resources are included to help learners scaffold their understanding of the main course materials, learners can decide if they wish to or need to go through all the materials. Hence, the focus of course completion should shift from completion of all materials to selected materials which are determined by the learner instead of being pre-determined by the content developer.

The role of the content developer is to ensure that the course materials and activities are engaging, supports active learning, and pushes a variety of learners to think deeper so they are engaged cognitively and socially through interaction with tutors or peers (Walji, Deacon, Small, Czerniewicz, & Czerniewicz, 2016). Cognition occurs when the learners interpret and process information internally according to their personal realities (Swan, 2004) while engaging with the content.

Hence, it is important that curriculum designers scaffold learning by providing materials and tools to support those who have a different depth of content knowledge and/or cognitive abilities so that learners can create
mental structures and personalise the knowledge that they gain from the main curriculum. Thus, the building of the online curriculum should go beyond the main syllabus. Supplementary, pre-course or pre-unit materials that target learners with little content knowledge, such as those from different disciplines or those with differing experiences as well as materials for those with undeveloped cognitive abilities, should be provided and clearly identified as optional foundation materials. Educators can also consider providing post-course materials or clear indications of what learners could read or do next could, particularly for those who wish to pursue their interest and extend their knowledge beyond the main curriculum, such as delving deeper into specific content areas or exploring other related content areas.

In keeping with the spirit of inclusive education, online course materials should include clearly labelled foundation materials, main course materials and post-course materials which learners can choose to interact with depending on their interest and needs. Hence, we should rethink the idea of course completion, especially for online courses.

**Keywords**
Inclusive education, curriculum design, online learning, MOOCs

**References**


Undergraduate teaching assistants as co-curators for the “Learning to Learn Better” module: What they did and what they learned

Hui Ru TAN1,2,3,*, Aaron R. JEYARAJ1,4, Balakuru S/O MAHENDRAN1,5, Jing Yi POH1,6, Magdeline Tao Tao NG1,7, Robert K. KAME1,8, Joshua J. GOOLEY1,9,10 and Fun Man FUNG1,11*

1 Institute for Application of Learning Sciences and Education Technology
2 NUS Graduate School for Integrative Sciences and Engineering
3 Food Science and Technology Programme
4 Brown University, USA
5 Department of Chemical and Molecular Bioengineering, Faculty of Engineering
6 Department of Economics, Faculty of Arts and Social Sciences
7 NUS Libraries
8 Department of Paediatrics, Yong Loo Lin School of Medicine
9 Center for Cognitive Neuroscience, Duke-NUS Medical School
10 Programme in Neuroscience and Behavioral Disorders, Duke-NUS Medical School
11 Department of Chemistry, Faculty of Science

huiru.tan@u.nus.edu and fun.man@nus.edu.sg*

How to stay motivated during college? What are proven and effective strategies to ensure long-term retention of content? Why is pulling an all-nighter to cram for an exam an ineffective strategy? Our now two-year-old module “Learning to Learn Better” (LTLB) seeks to answer these questions based on the latest research in psychology and the learning sciences. Analysing key findings published in peer-reviewed journal articles, the module instructors frame them into practical tips that students can employ to succeed in both their studies and the learning of other skills.

Grounded in collaborative teaching, the diverse teaching team consists of instructors from among NUS faculty and undergraduate teaching assistants (TAs). Instructors take turns to lead each lesson and the ones who are not leading actively chip in to provide their perspectives on the topic. This adoption of a flexible and rotation-based teaching is helpful in sustaining students’ interest in the module as they are frequently exposed to new teaching styles from different instructors (Walters & Misra, 2013).

TAs are actively involved in the module—from planning the module’s curriculum to the execution of lessons. TAs have the flexibility to create course materials (e.g. presentation slides and module information booklet), given the freedom to share any relevant experiences during lectures, and are encouraged to propose new content that would benefit undergraduates in their learning journey.
The involvement of TAs provide faculty with insights, from the perspective of undergraduates, on the aspects of learning students struggle the most with, and in identifying learning strategies which students are interested to acquire. This allows the team to refine the module’s curriculum to include content that students view as important and necessary.

Previous studies also indicated that involving student TAs in curriculum planning improved students’ levels of satisfaction for the module (Cordner, Klein, & Baiocchi, 2012; Mihans, Richard, Long, & Felten, 2008). Moreover, with TAs facilitating group discussions, students are given more attention and prompt feedback, providing them with a richer learning experience (Cordner, Klein, & Baiocchi, 2012). For example, students were to share on the IVLE (now LumiNUS) forum their learning takeaways after each lesson. The TAs would engage students in in-depth discussions on the forum, and many interesting and thought-provoking questions were raised. The concepts that many students find confusing, such as the difference between interleaving and spacing techniques, were communicated to the teaching team. This prompted the instructors to include a more detailed explanation on interleaving and spacing in their subsequent lesson plan, which helped to clarify and reinforce these concepts.

In addition, TAs were involved in pre-lesson meetings to discuss the content to be included in the next lesson. One of the TAs proposed an activity to demonstrate that drawing is more effective than re-writing in achieving long-term retention of content (Rinne, Gregory, Yarmolinskaya, & Hardiman, 2011). The faculty members were very supportive and allowed the TA to include it in the upcoming lesson. Although the class was not entirely convinced that drawing is better than writing after completing the activity, the faculty members were encouraging and gave constructive feedback on how to improve the activity. The teaching team’s open-mindedness encouraged the TAs to continually explore new concepts and try new activities that might be beneficial to students.

In this presentation, past and current TAs will share their experiences as members of the teaching team as well as co-curators of the module. The sharing will focus on:

1. how they contributed to lesson planning and execution;
2. memorable encounters they had with students taking the course; and
3. their reflection on what they learned

Brief Description of Images
Photographs taken during class which show students participating actively in in-class activities and group discussions, as well as the teaching team enthusiastically explaining the course material will be included in the PechaKucha presentation. Images of group meetings and work done behind the scenes will also be featured. The TAs will also use images to share heartwarming and memorable experiences they had with students.
Acknowledgements
We thank Assoc. Prof. Soo Yuen Jien and Mr. Syed Abdullah from the NUS School of Computing for their support in building the learning app “Coach L”. We thank our previous TA Jasper Chua Tee Loong for volunteering his time as TA over two semesters. We appreciate the participation of educators from the Department of Educational Development (EDU) at the Singapore Polytechnic, and Duke-NUS in our LTLB lesson observations.

We also acknowledge the USPC-NUS grant (2018-01-EDU/USPC-NUS) “A Frontier in Learning Science Educational Research Across two Nations—Learning to Learn Better (L2LB)”, Yeo Sing Chen and team for supporting the sleep research study in this course.

Keywords
Undergraduates; learning sciences; mentorship; collaboration; teaching assistants

References


Appendix

This section will include some examples of images that will be featured in the presentation.

**Figure S1.** Some major topics and concepts covered in LTLB lessons.

![Figure S1](image1.png)

**Figure S2.** Dr. Magdeline Ng (right), leading a group discussion to gather feedback on areas for improvement and to understand the learning needs of students taking the module.

```
Dear Mr Fun Man,

Firstly, I would like to apologise for sending you this delayed email as I have been caught up with my internship work for the past few weeks.

I am writing this email to express my interest to be a TA for ALS1010 and/or ALS1020 in the upcoming semester. I am wondering if there are still vacancies for the position?

After receiving my results today, I noticed that my grades have improved tremendously. I believe that I could not have achieved this improvement without the help of the knowledge gained from these 2 modules, particularly Learning to Learn Better. As a result, I am really inspired to share my experiences with the incoming batch of students and also to assist the teaching team (as I am really thankful to all of you for the great learning journey in ALS1010 and ALS1020 during AY2018/19 Semester 2).

Thank you and I hope to hear from you soon!
```

**Figure S3.** A screenshot of an email from one of the students expressing her appreciation to Mr. Fung Fun Man after seeing vast improvement in her recent examination grades.
Figure S4. Syed (right), an undergraduate leading the Coach L initiative*, guiding students on how to use the mobile application.

*The Coach L initiative is a collaboration between the LTLB module and NUS School of Computing to develop a proprietary mobile application that students and instructors could use to share and access course materials.
Technology, used correctly, can aid students in their learning (Curley, Wu, & Svirskis, 2018). With time, technological aids have achieved higher fidelity, progressing from 2D images over videos to interactive, virtual reality experiences. However, videos with higher production quality or media content with higher fidelity are not necessarily associated with better learner results (Guo, Kim, & Rubin, 2014). According to the literature, giving students the ability to explore and interact with content enhanced through technology (i.e. virtual reality experiences) results in experiential learning for them, which has been shown to increase retention of content (Ti et al., 2009; Bauerle & Park, 2012).

At the same time, while creating high-fidelity interactive environments, such as in virtual reality, can yield learning benefits for students, it is also costly, time-consuming and requires extensive skillsets, putting it out of reach for most educators or even educational institutions (Versatile Techno, 2017). 360° videos can provide a solution for creating interactive, engaging content at a skill and budget level that is accessible to more educators and institutions.

In line with this, our team, a student-teacher collaboration project, used 360° videos and annotation tools to create low-cost virtual excursions for experiential learning. Using 360° cameras and an annotation tool (uptale.io), students and educators co-created “explorable” environments, where learners were able to choose the direction they wanted to look at in each environment, as well as to “move” between environments. The virtual excursions also included relevant information and other interactive elements, such as quizzes. The topics and scenes were chosen by students and educators to ensure the best learning results.
Since creating 360° content with cameras and annotation tools requires little training and technological literacy, students from any background can be included to co-create virtual reality content with the educators. This co-creation is important to foster student-teacher interaction, as it shifts the role of the educators from being instructors to enablers of learning, and students take increasing responsibility of their own learning (Ribes-Giner, Perello-Marín, & Díaz, 2016). This in turn has a positive effect on learner control and learner flexibility (Bowden & D’Alessandro, 2011), which has been proven in a multitude of studies (Ribes-Giner, Perello-Marín, & Díaz, 2016). Importantly, the process of co-creation can increase student satisfaction (Ribes-Giner, Perello-Marín, & Díaz, 2016), and is thus a vital component to effective teaching. Higher student satisfaction has a proven, albeit not exclusively positive, effect on performance, which could be utilised to improve the student learning experience (Alcalde & Nagel, 2015).

Another significant lesson that our project demonstrates is that co-creation of content can also serve as a method to engage students in the creation of learning content, which give students the opportunity to interact more with the content to be taught. This can be seen as “cognitive engagement” (Martin & Torres, n.d.) which keeps learners invested in the content to be learned. Importantly, student engagement can be a vital tool in addressing underperformance and student disinterest (Fredricks, Blumenfeld, & Paris, 2004).

Furthermore, the co-creation as well as the explorative nature of the 360° environment provide students with a more active learning environment. Even small amounts of active learning included in the teaching have been shown to be beneficial (de Caprariis, Barman, & Magee, 2012), leading to improved grades and lower failure rates compared to traditional lecturing (Freeman et al., 2014). The greater level of control afforded by explorable environments, such as those found in virtual reality—or, as we have proposed, interactive 360° videos—has been shown to achieve increased student performance, learning effectiveness as well as satisfaction (Ai-Lim Lee, Wong, & Fung, 2010).

In summary, we created interactive and “explorable”, low-budget experiences in a virtual reality environment. Such experiences give students “access” and the opportunity to explore environments which are otherwise difficult or impossible to visit in a normal classroom teaching.

In this PechaKucha presentation, we will share with the audience the benefits of using 360° videos for learning and teaching, especially compared to virtual reality solutions. We will also share how educational 360° content can be created and demonstrate how students can be engaged in the development process.
Acknowledgements

We would like to thank all those who have enabled and supported this project and brought it to fruition, especially to the following collaborators:

- Assoc. Professor Peng Chung CHEOW and Professor Robert K. KAMEI from Duke-NUS
- Dr. Thierry KOSCIELNIAK from Conservatoire National des Arts et Métiers

We would also like to acknowledge the support given via the USPC-NUS grant (grant code 2018-02-EDU/USPC-NUS) “Project VIPER: Virtual Reality and Innovative Pedagogy in EnRiched Environment.”

Keywords

360° video, virtual reality, experiential learning, virtual learning, technology

References


Inclusive learning in classroom curricula and activities through authentic learning pedagogy

KUAN Yee Han
Tembusu College
yeehan@nus.edu.sg

Different students naturally engage a module at various levels to maximise their learning, which may be influenced by educational experiences, social environment, or even the basic cognitive structure of the individual. In this PechaKucha presentation, I will be sharing my approach in classroom curricular design using authentic learning to reflect inclusivity and diversity in learning. Authentic learning is an approach in which the learning tasks and assessments are situated within the context of real world situations to maximise learning, "allowing students to experience the same-problem solving challenges" as they would in the real world (Herrington, Reeves, & Oliver, 2014). Using a variety of approaches in the module design, it has made my classroom more inclusive for students, who enroll for this module with different prior experiences and learning strengths. This is particularly important in a residential college setting as students are enrolled in small classroom seminar-style modules (15 students per class), which are multidisciplinary in nature.

Applying to each seminar section of the module UTS2114 “Technologies and Ageing in Singapore” that I taught in Semester 2 of AY2018/19, students came from at least 11 different departments from 6 faculties at NUS (Faculty of Arts and Social Sciences, School of Design and Environment, Faculty of Science, NUS Business School, Faculty of Engineering, and School of Computing). The diversity in students’ educational background would require effort and strategies on the faculty member’s part to develop an inclusive classroom (Sanger, 2018). This is to ensure that students are actively engaged during the classroom activities. To enhance student engagement, I also engaged a teaching assistant (TA) who took the module previously to assist in facilitating some sessions. This partnership helped to bridge the differences in the perspectives and perceived learning between faculty member and students (Ouellett & Sorcinelli, 1995). I co-facilitated some sessions with the TA, which enhanced the learning experience for students in a diverse classroom. This observation was also highlighted in the module feedback, in which one student commented that "[the] teaching assistant contributed greatly to class discussions".

I will elaborate further on the practical aspects involved in creating an inclusive classroom with the examples below:

1. **Variety of Learning Activities.** The curriculum integrated different types of activities throughout the semester to help students with diverse backgrounds and approaches to learning. Examples included authentic learning activities with the ageing body suit (Figure 1), open-ended discussion with role-
playing on hard conversations about end-of-life care, research projects on ageing issues in Singapore, and reflections on their learning journey.

Figure 1. A student wearing an elderly body suit.

2. **Group Work and Collaboration.** During class, students would support their classmates and bring their different talents and ideas together for shared projects. It was observed that students seemed to perform better in situations that required idea-generation, such as in brainstorming session as seen in Figure 2. It was also observed that it seemed easier for students to speak up and not feel judged in a small setting. The groups were also rotated in every class so that students would get to work with different peers.

Figure 2. Questions for students to think about during their group brainstorming session in designing an ideal nursing home for the elderly.
3. **Inclusive Participation.** All students enrolled in the module were encouraged to participate in a collective group work where each student would have the opportunity to share their ideas with their peers. One of the facilitation tools used was Lego® Serious Play® to promote 100-100 interaction and discussion among students as seen in Figure 3 (100% of the students participate 100% of the time). Students were guided through a series of challenging questions and each student had the chance to build, share, and reflect.

![Image of students using Lego Serious Play](image-url)

*Figure 3. Models that were built by students collectively using LSP*

In conclusion, developing an inclusive course and classroom remains an ongoing effort, and would evolve depending on the diversity of student profiles and backgrounds. Deliberate design of the curricular and activities using authentic learning is an approach educators can consider for their courses, especially for students from multidisciplinary backgrounds. This is so that students can engage in meaningful discussions with their peers and learn effectively.

**Keywords**
Authentic learning, experiential learning, learning styles
References


Gallery Walk
(Poster Presentations)
Effects of planetarium-based instruction on undergraduates learning astronomy

Ummu Sumaiyah Binte ELIASE and NG Shao Chin Cindy*
Department of Physics, Faculty of Science
cindy.ng@nus.edu.sg*

Planetariums are an oft-used tool in the teaching of astronomy. Today, innovations such as the portable fulldome have increased the accessibility and practicality of planetariums. A key focus of planetarium education research is to analyse the value of planetarium-based instruction in different contexts. It is also important to consider learning theories like the Multiple Intelligences (MI) theory or the Visual, Auditory, and Kinaesthetic (VAK) theory for a more inclusive classroom (Kovalenko, 2019). While numerous studies on similar topics have been conducted, few have targeted university students in Singapore. As age, education, and cultural background all have effects on student learning (Cai, 2004), our study is therefore relevant to all who wish to diversify their lesson plans using a planetarium.

With a hemispherical (domed) screen stretching from floor to ceiling in all directions in dark room, the fulldome planetarium affords a more immersive environment for learning. The planetarium video may be used to simulate presence and movement in an idealised space, allowing for direct demonstration of topics that rely on spatial or 3-D thinking. (Sumners, Reiff, & Weber, 2008)

We attempt to compare the efficacy of the fulldome planetarium against the flat 2-D screen as visual aids in teaching celestial motion to undergraduate students. 126 students participated in this study. They came from across undergraduate levels and majors, and were reading the module GET1043 “Universe, Big Bang and Unsolved Mysteries” offered by the National University of Singapore.

Students sat through a 0.5-hour lecture on celestial motion followed by a post-test. The lecture covered the following topics: motion of the sun, moon, stars, and planets across the sky; the Milky Way’s shape and appearance; the retrograde motion of planets; and lunar phases and eclipses. Data was taken across the performance of 8 classes which were taught identical lessons using the sky simulator Stellarium: half in a planetarium setting, and the other half in a classroom setting. Students observed the simulated motion of celestial objects through hours, days, and years.

We used the post-test only quasi-experimental model while considering student responses for the midterm test. Post-test questions were constructed using Bloom’s taxonomy as a framework and tested the students’ ability to recall and understand the lesson content. Quantitative data collected include the percentage of correct answers and discrimination indices per question along with the overall score. While students across all groups had similar overall scores, analysis of individual questions revealed that being taught in a
planetarium setting led to slight improvements in the quality of student learning in cases where 3-D thinking was required, verifying previous claims (Türk & Kalkan, 2015). It was observed that what students can see of the sky in the fulldome environment is limited by their field of view, whereas the flat projection in the classroom presents a view of the entire sky. This could explain why classroom groups performed better than planetarium groups in questions/cases where a full view of the sky may have been beneficial to student learning.

Student’s background information and feedback for the lesson were collected using two surveys. The feedback indicated that students who attended the planetarium session were more likely to respond positively about the lesson. The feedback has also highlighted issues such as students’ levels of comfort in the planetarium, which may affect their performance. Most students identified themselves in the survey as visual learners, even though we observed that classrooms with more kinaesthetic learners seemed to underperform slightly in the post-test even with the aid of a planetarium. This points towards the need for diversification of teaching methods even with the inclusion of a planetarium as a visual aid, which is consistent with the conclusion reached by Slater and Tatge in their review of planetarium education research (Slater & Tatge, 2017).

Statistically, our study appears to lack significance and has a low Cronbach alpha of 0.24. We suggest that the study be repeated using a validity-tested instrument like the Test of Astronomy Standards (TOAST) (Slater, 2015). However, our research does bring up certain points of interest regarding the implementation of a planetarium in teaching university-level students.

**Keywords**

Planetarium, fulldome, undergraduate, astronomy, education
References


Kovalenko, N. (2019). Astronomy: Learning theories applicable for education in planetarium environment. *EPJ Web of Conferences, 200*, 01014. [https://doi.org/10.1051/epjconf/201920001014](https://doi.org/10.1051/epjconf/201920001014)


Slater, T. F., & Tatge, C. B. (2017). Affective domain research in the planetarium. In T. F. Slater & C. B. Tatge (Eds.), *Research on teaching astronomy in the planetarium* (pp. 101–125). [https://doi.org/10.1007/978-3-319-57202-4_5](https://doi.org/10.1007/978-3-319-57202-4_5)


Exploring students’ perception of feedback in computing internships

Bimlesh WADHWA1*, Mark GAN2, Li Shiyu3, and Sarah CHEAH4

1School of Computing
2Centre for Development of Teaching and Learning
3NUS Business School
bimlesh@nus.edu.sg*

Despite the essential nature and growing popularity of internships in computer science, little research has been conducted to investigate the role of feedback and their effectiveness in learning. We combined the findings from a pilot study (Cheah, Gan, Li, & Wadhwa, 2019) with insights from personnel and knowledge transfer literatures to explore students’ perception of feedback from academic and company advisors. In the undergraduate degree programme at the NUS School of Computing (SOC), students undergo at least one internship project in which they typically receive periodic feedback from company advisors. A delayed or ineffective feedback not only results in project delays and rework, it also affects student learning and satisfaction.

We believe that task level feedback, though powerful in correcting faulty interpretations (Harackiewicz, 1979), is not sufficient for deeper learning in project-based learning. Feedback needs to contain guidance on the process i.e. how to proceed with rejecting erroneous hypotheses and improving on searching and strategising (Earley, 1988). In addition, it should provide information that opens up more opportunities for learning, such as enhancing self-regulation (Hattie & Timperley, 2007) and refining strategies to work on tasks. Feedback that attends to self-regulation is powerful as it leads to further engagement into the tasks (Butler & Winnie, 1995). Furthermore, timeliness and regularity of feedback is important too. Timely interaction with specific feedback could help students more effectively navigate the experiential learning journeys in their internships.

In this study, we attempted to measure students’ perception of feedback in computing internship projects and explore how they use the feedback from company and academic advisors. The key research question we aimed to address was:

How do computing students perceive and use feedback from advisors during an internship project?

This study adopted the framework by Hattie and Timperley (2007) on the power of feedback to conceptualise feedback for learning at three levels: task, process and self-regulation. The participants for this study comprised of 39 SOC undergraduates taking CP3880 “Advanced Technology Attachment Project (ATAP)”, with a mix of both male and female students between the ages of 22-25. Each student carried out the project individually and went through ATAP under the guidance of one academic and one industry advisor.
(see Figure 1 for the design of the study). The ATAP is typically divided into three stages: (a) Scoping the objectives and requirements (b) Designing and implementing the solution, (c) Presenting the deliverables, including a report. The industry advisor reviewed student’s work monthly and provided written feedback on their progress. The academic advisor provided feedback at stages (a) and (c). Student’s interactions with the industry advisor’s feedback were usually ad hoc in nature. Note-taking and use of feedback were left to the student, with no formal mechanism of reflection or way for students to respond on how they would use the feedback provided.

The instrument used for this study is a survey questionnaire with three sections—(i) perception and use of feedback in achieving learning outcomes; (ii) perception and use of feedback given by the company advisor for the internship project; and (iii) perception and use of feedback given by the academic advisor for the internship project.

Findings showed that students perceive feedback as very useful, and they recognised the importance of feedback from the advisors. A big part of the feedback occurred through the discursive feedback interactions between the student and company advisor. Students recognised that the feedback enabled them in task completion, deepened their procedural understanding and prompted self-monitoring processes. The quality of feedback was found to differ across company and academic advisors. Students showed reasonable satisfaction levels for company advisors’ feedback at critical milestones in their project. However, the feedback from academic advisors were found to be less useful, and low in specificity.

From these initial findings, we offer recommendations for advisors to enhance internship effectiveness and suggestions for researchers interested in studying feedback as a determinant of computing internship effectiveness. Our recommendations highlight the need for improved feedback interactions at task, process and self-regulation levels, and effective use of feedback guidance for students to improve their learning during internship projects.

Figure 1. Internship module flow
Keywords

Feedback, computing internship, industry projects, self-regulation

References


Creating an inclusive outdoor learning framework in a residential college

LIM Cheng Puay and Norman NEW Chin Guan
Ridge View Residential College
chengpuay@nus.edu.sg and normannew@nus.edu.sg

Individual learning and change as a result of direct experiences is one of the principal aims of experiential learning (Hovelynck, 2001). The main stage for experiential learning is often the outdoor classroom. Outdoor learning programmes focus on personal and interpersonal development for individuals and groups, from diverse backgrounds and in a variety of environmental settings (Hans, 2000).

Anchored in experiential learning, the Ridgeview Residential College’s (RVRC) co-academic curriculum uses the Levels of Service (LoS) Framework (Treffinger & Selby, 2009; Renzulli & Reis, 2010) to design appropriate learning experiences, from level-wide activity for the general cohort to specific opportunities for the few. The key tenets of the LoS is that it is a flexible, inclusive, and unifying framework catering to the needs of different kinds of activities, places, and people.

Using the LoS approach, RVRC created an outdoor learning framework with these two salient features:

1. An accessible and developmental outdoor programme that caters for all RVRC students in diverse environmental settings.
2. Equal opportunities for interested students to step out of their comfort zone and further pursue their diverse interests.

The first tier of the framework rests on three compulsory outdoor activities which all students entering RVRC in their first year participate in. The activities are based on three themes: (1) Environmental stewardship, (2) Knowing your backyard, (3) Outdoor experiences beyond the academic classroom. These activities are catered to be inclusive for all students.

For environmental stewardship, all Year 1 students participate in a beach cleanup at Tanah Merah Beach where they directly observe the impact of marine trash in Singapore. Students also learn about the physical environment surrounding RVRC through a 10km walk from RVRC to Mount Faber. As part of a discussion on “Sustainable Urban Buildings”, students attend an outdoor learning session assessing the various green features in a designated building in NUS.
The second tier of the framework is flexible in incorporating academic and co-academic activities which students are free to join based on their level of interest. RVRC offers second year forums with a number of topics focusing on outdoor learning. Students can sign up for forums such as “Exploring Singapore’s Southern Islands in a kayak”. RVRC also organised its first Youth Expedition Project (YEP) to Shangri-La, Yunnan, China, where participants worked on waste management and sanitation projects.

This poster presentation will share students’ perception of what they learned from the Shangri-La YEP project in relation to the RVRC outdoor learning framework.

A quantitative survey was conducted to assess whether the 16 students who participated in the Shangri-La YEP project felt that it contributed to their personal growth and development as well as challenged them to step out of their comfort zones. 100% of the students strongly agreed or agreed that the project helped them “develop greater self-awareness”. All strongly agreed that the project helped them “develop greater effectiveness in working with others”. 90% of the students strongly agreed that the project “stretched them physically, emotionally and intellectually”. These findings suggest that the project has added value to the students’ personal growth and development. The students were also stretched holistically. These findings were further supported with reflections from the students.

The LoS framework proved to be a flexible and informative tool to organise and also plan for the outdoor learning provisions for the students in a residential setting. RVRC would be focusing on including staff development and exposure to outdoor education with this framework in the future.

**Keywords**

Curricular design, outdoor learning, inclusivity
References


As educators, we do not often know what misconceptions students might have from attending our lectures, unless they ask questions. Or we discover, too late, that there were misconceptions after the review of the assessments or examinations. We also do not know what thoughts students might have until we receive the students’ end-of-semester feedback, unless we actively interact with them and seek their feedback, provided they reveal such information truthfully.

To address some of the misconceptions students may have, educators have adopted clickers (Sevian & Robinson, 2011), the “K-W-L” reading strategy (Ogle, 1986), and the Immediate Feedback Assessment Technique (IF-AT) (Cotner, Baepler, & Kellerman (2008). These three examples are by no means exhaustive. While these are all good tools, they do not allow free-flow of thoughts nor can students ask questions. I wanted to know what questions students have and what their opinions or thoughts are regarding each lecture topic.

In this study, we focus on LMS1307 “Waste and Our Environment”, which was taught for the first time in Semester 1 of AY 2018/19. The cohort comprised 38 students from all levels from the Faculties of Science, Computer Science, Chemical Engineering and NUS Business School. I decided to adopt a simplified version of the book Making Thinking Visible by Ritchhart, Church, and Morrison (2011). I would like students to gain thinking skills outlined by Ritchhart and his colleagues (2011), which would help students develop their understanding of the concepts covered in LMS1307. These skills include: (1) observing and describing what’s there, (2) building explanation and interpretations, (3) making connections, (4) considering different viewpoints and perspectives, and finally (5) wondering and asking questions. The ones that I am omitting are (6) capturing the heart and forming conclusions, (7) reasoning with evidence, and (8) uncovering complexities and what goes on below the surface of things.

An A4 sheet of paper was given to each student to use throughout the semester to record any thoughts, questions or lecture content that they deem to be important. Some also used this opportunity to ask questions or give the lecturer feedback. Some students were prolific writers and required two to three more sheets. This piece of paper was also used to record their lecture and tutorial attendance which counted towards
their overall modular grade. They also had to complete post-lecture topical quizzes, which were used to check their level of understanding or whether they harboured any misconceptions of the module content.

The findings indicate that 92% of the class treated the whole exercise seriously and were very engaged. They used the A4 written platform and emailed the lecturer occasionally to ask questions (Skill 5), wrote down their notes for me to check for any misconceptions (Skill 1), wrote down their comments about lectures and their thoughts and feelings on the videos shown to them (Skill 2), connected different lectures and current affairs news to a particular lecture topic (Skill 3), and even provided feedback on the teaching assistants’ style of comments on their posters but were willing to accept my explanations and perspectives (Skill 4). Two of the students did not attend classes because of personal issues while one was a man of few words. By examining their submissions, they (92% of the class) gained to a greater or lesser degree all five skills. The quizzes also helped in identifying misconceptions and prepared students for the final examinations.

When compared with their final grades, those who did not give personal opinions or asked few questions but made neat notes scored A+ and A, while those who asked questions or gave opinions scored A- and B+. There was a strong correlation between attendance and quiz scores, and the students’ final grades. Students appreciated that I took their submissions seriously after each lecture (there were a total of 24 lectures). They appreciated my effort and recognised the diverse waste issues and how serious they were affecting the environment.

In future semesters, I will fine-tune this exercise of “making thinking visible” and consider giving students more time to develop Skill (7), which focuses on reasoning with evidence.

Endnote
1. “K-W-L” is a reading strategy that helps learners develop active reading of expository steps through a 3-step procedure of: K (“Knowing what we know”), W (“What do I want to learn?”), and L (“What I Learned”) (Ogle, 1986).

Keywords
Undergraduates’ learning, thinking, questioning, misconceptions
References


