

# **Blend and Flip for Teaching Communication Skills to Final Year International Computer Science Students**

by Tom Worthington

Research School of Computer Science  
Australian National University  
Canberra, Australia  
[tom.worthington@anu.edu.au](mailto:tom.worthington@anu.edu.au)

# Tom Worthington MEd FHEA FACS CP

- Honorary Lecturer in Computer Science at the Australian National University
- Past President, Honorary Life Member and Fellow of the Australian Computer Society
- Member of the ACS Professional Education Governance & Blockchain committees
- Blogs as the Higher Education Whisperer



# TechLauncher: Group Computing Project

- Developed by Dr Shane Flit, now run by Dr Charles Gretton
- Combines ANU project courses COMP3500, 3550, 3710, 4500 & 8715
- Students work on a *real* project, in a team for a *real* client, such as CEA.
- Last assessment task is to document what the *individual* learned, and how they learned it, in the form of a *job application*.

See: R. Awasthy, S. Flint, and R. Sankaranarayanan, "Lifting the constraints—closing the skills gap with authentic student projects," in 2017 IEEE Global Engineering Education Conference (EDUCON). IEEE, 2017, pp. 955–960.



HMAS Perth with a Phased Array Radar  
from CEA Technologies in Canberra

Source:

<https://www.flickr.com/photos/133059881@N02/19756029272>

# Learning to Reflect

Reflection is a valuable skill, but ...

1. STEM students have difficulty with this.
2. English speakers of other languages (ESOL) students have more challenges.
3. Group project students have difficulty switching to a solitary reporting activity.

# Approach to Teaching Reflection

- **Progressive:** series of exercises with time to reflect, and benefit from feedback,
- **Collective:** students benefit as much from *providing* feedback, as receiving it,
- **Scholarly:** explain why and how a reflective exercise is useful,
- **Limited:** don't claim a portfolio will be valuable career tool.

# Different Rooms for Different Pedagogy



Tiered Room in Sciences Teaching Building



Temporary flat floor classroom, Barry Drive



Wall screens & tables on wheels, Marie Reay Teaching Centre

# Learning Design Parallels Room Design

Align Assessment with Learning

Distance education + face-to-face workshops = Blended Learning  
in *Chunks* (Fleck, 2012)

Use of a Learning Management System

J. Fleck, "Blended learning and learning communities: opportunities and challenges," *Journal of Management Development*, vol. 31, no. 4, pp. 398–411, 2012.

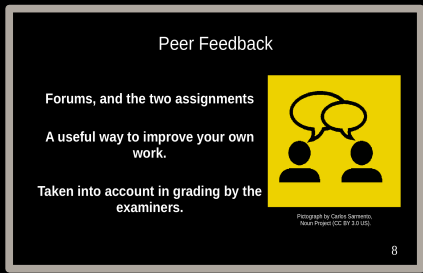
# Videos Made Without Mic., Camera, or Editing

Short videos made:

1. Edit notes down to script,
2. Create slides from script,
3. Create narration with text-to-speech software from script,
4. Add slides,
5. **Render video.**

Learning to Reflect Videos, Higher Education Whisperer, August 6, 2019:

<https://blog.highereducationwhisperer.com/2019/08/learning-to-reflect-video.html>



Introductory Video



# Standardized Workshop Format

Announcements

General Questions

Forum Questions

Master Class for Assignment

Wrap-up



ANU Marie Reay Teaching  
Centre

Cross-section diagram by BVN, 2018

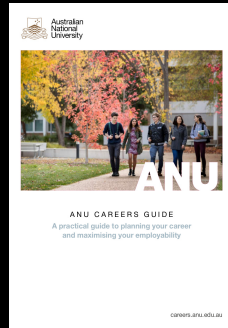
# Incorporating Co & Extra Curricular Material

Capstone task for student was to write a job application

Material from the ANU Careers Guide was used

Workshop exercises were designed & delivered by Tempe Archer, ANU Careers Consultant

Students encouraged to participate in the ANU Student Experience.



# Preliminary Results

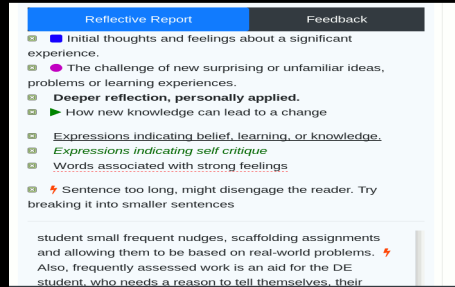
- Run with 80 masters of computing students in Semester 1 & 245 masters and undergraduates in Semester 2
- Students tended to give high performing students higher grades than instructors, and lower performing students lower grades
- Students peer assessed in same ranking as instructors
- Grades were close to those for the previous year, using lectures

No significant difference effect? (Nguyen, 2015)

T. Nguyen, "The effectiveness of online learning: Beyond no significant difference and future horizons," MERLOT Journal of Online Learning and Teaching, vol. 11, no. 2, pp. 309–319, 2015.

# Possible Improvements

- Reduce the number of forum posts to reduce confusion
- Change Marking Scheme to encourage systematic work
- Use co-curricular workshops, in place of custom ones
- Supplement tutors with writing analysis tools



The screenshot displays the UTS AcaWriter Tool interface. It features a blue header bar with 'Reflective Report' and a grey header bar with 'Feedback'. Below the header, a list of feedback items is shown, each with a colored icon and a description. The items are:

- Initial thoughts and feelings about a significant experience.
- The challenge of new surprising or unfamiliar ideas, problems or learning experiences.
- Deeper reflection, personally applied.**
- How new knowledge can lead to a change
- Expressions indicating belief, learning, or knowledge.
- Expressions indicating self critique
- Words associated with strong feelings
- Sentence too long, might disengage the reader. Try breaking it into smaller sentences

Below the list, a text box contains the following text:

student small frequent nudges, scaffolding assignments and allowing them to be based on real-world problems. Also, frequently assessed work is an aid for the DE student, who needs a reason to tell themselves, their

UTS AcaWriter  
Tool

# Conclusion

Replacing lectures with online exercises, group workshops, and peer-assessed progressive tasks is viable.

This reflects a social constructionist approach to scaffolded peer learning (Lindley, 2007).

A longitudinal study of this approach would be of value.

D. Lindley, "Computer professional education using mentored and collaborative online learning," in SEARCC 2007, Proceedings of the South East Asia Regional Computer Conference, 2007, pp. 18–19.

# More Information

TechLauncher:

[https://cs.anu.edu.au/TechLauncher/current\\_students/](https://cs.anu.edu.au/TechLauncher/current_students/)

Learning to Reflect Module for TechLauncher:

[https://www.tomw.net.au/technology/education/learning\\_to\\_reflect/](https://www.tomw.net.au/technology/education/learning_to_reflect/)

Tom Worthington, ANU Research School of Computer Science:

[tom.worthington@anu.edu.au](mailto:tom.worthington@anu.edu.au)

# **Blend and Flip for Teaching Communication Skills to Final Year International Computer Science Students**

by Tom Worthington

Research School of Computer Science  
Australian National University  
Canberra, Australia  
tom.worthington@anu.edu.au

Presented at the IEEE TALE engineering education conference, Yogyakarta, December 2019  
<https://tale2019.org/>


**Abstract:** In addition to technical knowledge, graduates in computing and engineering disciplines are expected to have communication skills, and the ability to undertake lifelong learning. These skills are difficult to acquire using conventional lecture and tutorial based teaching. Final year international graduate computer science students at the Australian National University, College of Engineering and Computer Science, were found to have particular difficulty when asked to write about their learning. In response, lectures were replaced with online exercises, group workshops in a new purpose-built flat floor classroom, and peer-assessed progressive assessment. This approach was trialed with eighty students in 2019. Preliminary results indicate students performed at least as well as with conventional lecture-based instruction.

**Index Terms:** assessment, e-portfolio, classroom, podcast, reflection, STAR-L, video, WIL, Work-Integrated

**Category:** Learning, Computing & IT Education

## Tom Worthington

- Honorary Lecturer in Computer Science at the Australian National University
- Past President, Honorary Life Member and Fellow of the Australian Computer Society
- Member of the ACS Education Governance & Blockchain committees
- Blogs as the Higher Education Whisperer



FACS CP

**About the Speaker:** Tom Worthington is an independent computer professional, educational designer and an Honorary Senior Lecturer in the Research School of Computer Science at the Australian National University.

A Certified Professional member of the Australian Computer Society, in 2015 Tom received a national gold Digital Disruptors Award for "ICT Education" and in 2010 was Canberra ICT Educator of the Year. Tom previously worked on IT policy for the Australian Government, and in 1999 he was elected a Fellow of the Australian Computer Society for his contribution to the development of public Internet policy. He is a Past President, Honorary Life Member, Certified Professional and a Certified Computer Professional of the society as well as a voting member of the Association for Computing Machinery and a member of the Institute of Electrical and Electronics Engineers.

Tom has a Masters in Education (specializing in Distance Education) from Athabasca University, a Graduate Certificate in Higher Education from the Australian National University and a Certificate IV in Training and Assessment from the Canberra Institute of Technology. He blogs as the HigherEducationWhisperer.com.

While an Honorary Senior Lecturer in Computer Science at the Australian National University, a member of the Blockchain Technical Committee and the Professional Education Governance Committee of the Australian Computer Society, his views here do not necessarily reflect those of either organization.




## TechLauncher Computing

- Developed by Dr [redacted] by Dr Charles Gretton
- Combines ANU project management courses COMP3500, 3550 and 3560 with 8715
- Students work on a real project in a team for a *real* client, such as CEA.
- Last assessment task is to document what the *individual* learned, and how they learned it, in the form of a *job application*.

See: R. Awasthy, S. Flint, and R. Sankaranarayana, "Lifting the constraints—closing the skills gap with authentic student projects," in 2017 IEEE Global Engineering Education Conference (EDUCON). IEEE, 2017, pp. 955–960.

Source:  
<https://www.flickr.com/photos/133059881@N02/19756029272>



TechLauncher is an ANU computer science program developed by Shane Flint, and now run by Dr Charles Gretton. It combines students from several undergraduate and postgraduate computer science project management courses, to work on real projects for a real client (Awasthy, Flint, & Sankaranarayana, 2017). As an example, several teams of students have worked on testing phased array radar for the Australian military.

After working as a team, the students last task for assessment is to prepare an e-portfolio and reflect on their learning. Student found this a very abstract task. As this was one of the last tasks to complete before graduating, it was changed to have the student apply for a job, a PhD program, a grant to set up a company, or whatever else they may be planning to do next. The student still has to document what they have done, what they have learned, and how they learned it, but in a practical form.

## References

Work Portfolio Package (WPP), TechLauncher, ANU, 2019  
[https://cs.anu.edu.au/TechLauncher/current\\_students/evaluation/work\\_portfolio\\_package/](https://cs.anu.edu.au/TechLauncher/current_students/evaluation/work_portfolio_package/)

R. Awasthy, S. Flint, and R. Sankaranarayana, "Lifting the constraints—closing the skills gap with authentic student projects," in 2017 IEEE Global Engineering Education Conference (EDUCON). IEEE, 2017, pp. 955–960.

## Learning to Reflect

Reflection is a valuable skill, but ...

1. STEM students have difficulty with this.
2. English speakers of other languages (ESOL) students have more challenges.
3. Group project students have difficulty switching to a solitary reporting activity.

Towards the end of their degree, computing students at the ANU may undertake a practical project, either as part of a team, or an individual internship [2]. The last assessment task for the practical project is a written exercise to reflect on learning. Reflection is a useful aid to learning and a valuable skill for a professional who is required to undertake lifelong learning. However, computing students have difficulty with this.

International students who are undertaking their studies in a language which is not their first have additional difficulties [3]. ESOL (English speakers of other languages) students have many challenges with technical writing [4]. Computing and engineering students and others in STEM disciplines undertake courses on how to carry out analysis of problems and present evidence. However, they are rarely asked to examine themselves as a subject. The emphasis is on the use of objective language, with the author removed from

the work. In addition, students undertaking group projects, or a workplace internship, are working with others on a collectively set goal. It is difficult at the end of this collective work to switch to a solitary reporting activity.

## Approach to Teaching Reflection

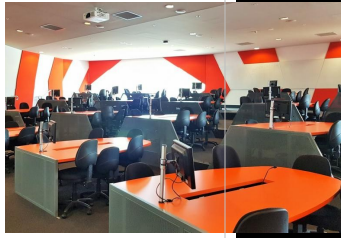
- **Progressive:** series of exercises with time to reflect, and benefit from feedback,
- **Collective:** students benefit as much from *providing* feedback, as receiving it,
- **Scholarly:** explain why and how a reflective exercise is useful,
- **Limited:** don't claim a portfolio will be valuable career tool.

Possible ways to help the students would be:

- **Progressive:** Rather than something required at the end of a course, break the preparation up into a series of exercises. In this way, students can be provided with time to reflect, and benefit from formative feedback on their work. However, for the student to work consistently, there has to be an incentive for doing the exercises on time, by making this a condition of course completion, or each a part of the assessment scheme, or both.

An example of what will not work is to ask the student to complete a reflective journal, but not provide feedback or assessment until the end of the course.

- **Collective:** Students will benefit from peer feedback on their reflections. The student benefits as much from providing feedback, as receiving it. However, students will need assistance in how to provide feedback if this is something they have not had to do before. Also, an incentive, such as making it a requirement, or assessing the feedback, is required.
- **Scholarly:** Students will benefit from learning a little of why and how a reflective exercise is useful to them. While not attempting to turn every student into a teacher, it would be useful for them to learn a little of the theory behind the reflective exercise. Some of the skills interns learn and report via their portfolio are in the area of Skill management, specifically “learning and development”, as defined in the Skills Framework for the Information Age (SFIA) [8]. It would be useful to have this listed in the learning objectives for the course, and then to point out to students this is a skill formally recognized internationally by the computing profession.
- **Limited:** The value of a reflective portfolio should not be overstated. Claiming the portfolio will be valuable career tool is not likely to be believed by the student, and will not motivate them. Students will have undertaken years of disposable assessment tasks which they complete, and then discard, before moving on to the next. The portfolio exercises can be structured so each builds on the last, but even so, it is too much of a leap of faith to believe any of this will be of use after the end of the course. MacKrell, Mhaisuria, and McDonald [9] investigated the gaps between what a university teaches and what is required by industry. Perhaps identifying these gaps could be an explicit goal of the portfolio exercise for each student. Learning what they have yet to learn might be the most useful outcome of the exercise.



## Different Rooms for Different pedagogy



Tiered Room in Sciences Teaching Building



Temporary flat floor classroom, Barry Drive

Wall screens & tables on wheels, Marie Reay Teaching Centre

The ANU campus has a previous generation of flexible learning space, in the Sciences Teaching Building, designed by Australian architects Lyons and opened in 2014. This accommodates one hundred and fifty students, seated at tables of five. The tables are fixed to the floor, on wide shallow tiers. This allows for short presentations, with all students focused on a speaker at the front of the room, and then group discussion around each table. However, the room has the disadvantages of both formats: with the low seating density of a flat floor classroom, and the fixed format of a tiered lecture theatre.

Two new teaching buildings opened at the Kambri precinct of the ANU campus in February 2019 by Australian architects BVN, with each designed for a different pedagogy. The ANU Cultural Center building has a few large auditoriums, with fixed high density tiered lecture theater seating. This is optimized for conventional lectures.

In contrast the ANU Marie Reay Teaching Centre, has smaller rooms, with lower ceilings, movable chairs, and wheeled tables. The seating density is much lower than the cultural center, and with the flat floor it is harder for a student, when seated, to see a presenter on the other side of the room. However, these rooms are intended for interactive group work by students, with formal presentations expected to be kept short, or replaced entirely by online "flipped" content [10]. By having two buildings, each optimized for a specific format, seating capacity can be maintained, with rooms better suited to each a teaching approach.

The room depicted has electronic screens on the side walls. A desk can be positioned below each screen. With six students per desk and two rows of three tables, the room can accommodate thirty-six students. As the cabling is in the wall, the screens cannot be moved, but the tables can be rearranged, as required.

## Learning Design Parallels Room Design

### Align Assessment with Learning

Distance education + face-to-face workshops = Blended Learning  
in *Chunks* (Fleck, 2012)

### Use of a Learning Management System

J. Fleck, "Blended learning and learning communities: opportunities and challenges," *Journal of Management Development*, vol. 31, no. 4, pp. 398–411, 2012.

The course design used here parallels the approach taken for the design of the rooms: for flexibility, but with efficiency.

#### **A. Aligning Assessment with Learning**

Top-down development implies that after the learning objectives are set, the assessment tasks are next defined. However, the course had been run previously with a capstone assessment task. Rather than make too many changes, the capstone was retained, and new small supplementary tasks added leading up to it.

The solution was to halve the marks allocated to the final assessment task and then distribute these to small preparatory exercises. The small exercises are automatically marked multiple choice quizzes, and peer-assessed short written tasks. Retaining the tutor assessed final task provided a level of reassurance for staff who were skeptical as to the reliability of automated and peer assessment.

#### **B. Blended Learning in Chunks**

At design time completion of new flat-floor classrooms was not certain, so a conservative approach to blended course design was used, with *chunks*: a distance education course, with face-to-face workshops inserted, to make it blended.

The student is provided with just two packages, both of two weeks duration. Each segment provides discussion questions, videos, one quiz, notes, suggested readings, plus instructions for an assignment. This contrasts with tightly scripted learning modules. The chunky approach can tolerate errors in the course design and can be used offline.

#### **D. Use of a Learning Management System**

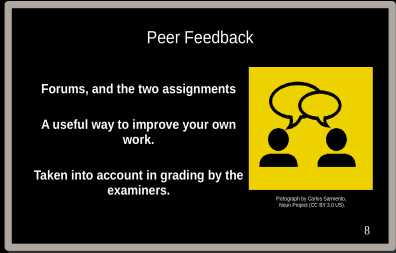
The Moodle Learning Management System was used for delivery of learning materials, communication from instructor to the class, to individual students and for assessment. A reading budget was set to ensure students were not asked to read too much. The course materials include notes in the form of an e-book, and videos with computer generated speech. These materials have been made freely available online, under a Creative Commons Licence.

## Videos Made Without Mic., Camera, or Editing

Short videos made:

1. Edit notes down to script,
2. Create slides from script,
3. Create narration with text-to-speech software from script,
4. Add slides,
5. Render video.

Learning to Reflect Videos, Higher Education Whisperer, August 6, 2019:  
<https://blog.highereducationwhisperer.com/2019/08/learning-to-reflect-video.html>



Introductory Video

Three videos were produced for the learning module:

1. Introduction (6 minutes): <https://youtu.be/-DMjC1CAsEQ>
2. Learn (13 minutes): <https://youtu.be/XC77WxIKutc>
3. Reflect (9 minutes): <https://youtu.be/4RROxZP8KaU>

To reduce the workload, these three videos were not produced using conventional recording or editing techniques. Instead the narration was generated from a script, with still images and stock footage added semi-automatically.


As a first step the text from the student notes was edited to make a script. Slides were then created for each section, much as would be done for a lecture. The script was then converted to audio using text-to-speech software. A tool which automatically identifies key phrases in the script and finds stock images and video was used to create a rough cut. The slides were then added in place of some of the stock images.

This process has considerable potential for educational video. There is no need of a recording studio, microphones, cameras, or presenters. Where a change is needed, the script can be edited and the video regenerated, in a few minutes.

For details of the process and tools used, see “Learning to Reflect Videos” Higher Education Whisperer, August 6, 2019:  
<https://blog.highereducationwhisperer.com/2019/08/learning-to-reflect-video.html>

## Standardized Workshop Format

- Announcements
- General Questions
- Forum Questions
- Master Class for Assignment
- Wrap-up



ANU Marie Reay Teaching Centre  
Cross-section diagram by BVN, 2018

All face-to-face workshops had the same simple format. This was done to make it simpler for students to follow. Also, it was uncertain if the new classroom would be available, so a conventional lecture theater might need to be used, requiring a change of format. The workshop schedule devised was:

- **Announcements:** While the room is configured (a requirement in a flexible classroom), announcements can be made.
- **General Questions:** Before starting on the workshop content, students can ask about any administrative matters, clarification of content, or assessment requirements.
- **Forum Questions:** Students discuss the answers they posted online, in table groups. Volunteers then present the results of the table discussion to the whole room.
- **Master Class for Assignment:** As with the forum questions, students first discuss issues with the forthcoming assignment in table groups, then room-wide. Volunteers put drafts of their work on the screen for room-wide feedback.
- **Wrap-up:** Time is provided at the end of the workshop for concluding remarks and questions.

Using the same format for all workshops allows instructors and participants to become comfortable with approach. Also valuable time is not wasted in class on explanations of what the students are to do.

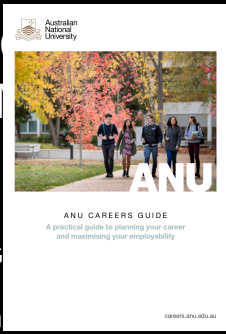
# Incorporating ANU Careers into a Curricular

Capstone task for student was to prepare a job application

Material from the ANU Careers Guide was used

Workshop exercises were designed by Tempe Archer, ANU Careers Consultant

Students encouraged to participate in the ANU Student Experience.



As well as materials on preparing a job application from academia, industry and government, material from ANU Careers was also used, particularly the ANU Careers Guide (2018).

The workshops were all designed with a generic format, where students review what was done online and prepare for the next assignment. However, ANU Careers offered customized versions of their workshops for students. These were designed and delivered by Tempe Archer, ANU Careers Consultant.

Students were also encouraged to identify what additional training they needed and to get that through ANU Student Experience, or elsewhere.

## Reference

ANU Careers Guide: A practical guide to planning your career and maximising your employability, Version 7, ANU Careers (2018). URL <http://www.anu.edu.au/files/resource/DSA173813%20Careers%20Guide%20v7%20WEB.pdf>



## Preliminary Results

- Run with 80 masters of computing students in Semester 1 & 245 masters and undergraduates in Semester 2
- Students tended to give high performing students higher grades than instructors, and lower performing students lower grades
- Students peer assessed in same ranking as instructors
- Grades were close to those for the previous year, using lectures

No significant difference effect? (Nguyen, 2015)

T. Nguyen, "The effectiveness of online learning: Beyond no significant difference and future horizons," *MERLOT Journal of Online Learning and Teaching*, vol. 11, no. 2, pp. 309–319, 2015.

The learning module was run with 80 masters of computing students in early 2019. Overall, the student's peer assessment resulting in the same ranking of students as instructor assessment. However, students tended to give high performing students higher grades than instructors, and lower performing students lower grades.

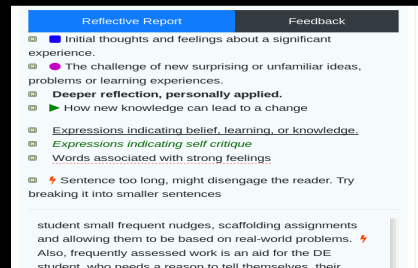
Results were close to the overall results for the previous year's cohort of students, using lectures. However, it is possible that, as with other studies of conventional, versus technology-assisted learning, the "no significant difference" effect is in play (Nguyen, 2015).

### Reference

- T. Nguyen, "The effectiveness of online learning: Beyond no significant difference and future horizons," *MERLOT Journal of Online Learning and Teaching*, vol. 11, no. 2, pp. 309–319, 2015.

## Possible Improvements

- Reduce the number of forum posts to reduce confusion
- Change Marking Scheme to encourage systematic work
- Use co-curricular workshops, in place of custom ones
- Supplement tutors with writing analysis tools



UTS AcaWriter  
Tool

### A. Reduce the number of forum posts

- One question per forum: One should be sufficient to keep students engaged.
- Reduce posting rate: Approximately one-quarter of students left it until the just before the deadline to make all their forum posts. The forum could be set to allow only one post per day, requiring them to spread out their posts.
- Use tutorial cohorts: Having around 100 students in one forum resulted in an excessive number of postings for students to read. Dividing students into groups of about 24 would make this more manageable.

### B. Change Marking Scheme

- Fewer marks for early assignments: The first assignment is a practice run for the final exercise, so could have reduced marks and the second, increased.
- Increase the number of peer reviews on assignment: The Moodle workshop algorithm requires at least three peer reviews of each assignment to assess the quality. Ask each student to do four reviews would provide a suitable margin.
- Simplified scale for small assessment items: It can be difficult for peers (and even instructors) to grade on the seven-point scale used. So for small exercises, a simpler three-point scale could be used.
- Have small assessment items contribute only up to a medium-range grade: This technique has been used at ANU previously, to ensure that students can't get a high grade, just from the small exercises (Worthington, 2012). To ensure students actually do the small tasks, require them to get 50% for the total of these, to pass the course.

### C. Use standard careers workshops in place of custom ones

- In place of workshops just for TechLauncher students, these students could attend those offered university wide. This would allow students to be offered a choice of times to attend.

### D. Supplement tutors with writing analysis tools

- Tools such as the free open source UTS AcaWriter software, can be used to help students with reflective writing (Aileen, 2019).

## Conclusion

Replacing lectures with online exercises, group workshops, and peer-assessed progressive tasks is viable.

This reflects a social constructionist approach to scaffolded peer learning (Lindley, 2007).

A longitudinal study of this approach would be of value.

D. Lindley, "Computer professional education using mentored and collaborative online learning," in SEARCC 2007, *Proceedings of the South East Asia Regional Computer Conference*, 2007, pp. 18–19.

Final year international graduate computer science students at an Australian university engineering college undertook online exercises, group workshops, and peer-assessed progressive tasks to assist students to learn to write about learning. The students trialing this approach in 2019 were able to achieve results comparable to a previous class using conventional lectures. These skills are difficult to acquire using conventional lecture and tutorial based teaching. Replacing lectures with online exercises, group workshops, and peer-assessed progressive tasks appears a viable alternative.

The aim of this work was to deliver a usable unit of instruction for students, rather than conduct formal research. What has been implemented reflects a social constructionist approach to scaffolded peer learning (Lindley, 2007).

A longitudinal study of this approach would be of value. However, it is possible that, as with other studies of conventional, versus technology-assisted learning, the "no significant difference" effect is in play. As teachers, we can only provide an environment for students to learn, and then leave it to them to learn.

### Reference

D. Lindley, "Computer professional education using mentored and collaborative online learning," in SEARCC 2007, *Proceedings of the South East Asia Regional Computer Conference*, 2007, pp. 18–19.

## More Information

TechLauncher:

[https://cs.anu.edu.au/TechLauncher/current\\_students/](https://cs.anu.edu.au/TechLauncher/current_students/)

Learning to Reflect Module for TechLauncher:

[https://www.tomw.net.au/technology/education/learning\\_to\\_reflect/](https://www.tomw.net.au/technology/education/learning_to_reflect/)

Tom Worthington, ANU Research School of Computer Science:

[tom.worthington@anu.edu.au](mailto:tom.worthington@anu.edu.au)