

# Education case study reports reflection on teaching strategies for pharmacy students

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## Abstract

**Introduction:** Teaching should meet the needs of all types of learner present in the class room; the activist, the reflector, the theorist and the pragmatist who also have diverse backgrounds, levels of education and are from different age groups.

**Aim:** The aim of the four projects was to improve students' engagement and success.

**Method:** New teaching strategies were trialled to improve students' engagement and successes with topics which according to their feedback were considered 'dry'. The author utilised techniques such as flipping the class-room, simulation, case or problem based learning; and group work replacing traditional lectures. First, third and fourth year students were asked to prepare for the in-class activities at home using the lectures or simulation software.

**Results:** The strategies were effective in a small class size of 15-20 students, with improved attendance and participation, improved fail/pass rate and number of students achieving credit or pass; however there was no significant change in the number of students achieving high distinction or distinction.

**Evaluation:** Reproducibility is an important part of the experiment to demonstrate that the results can be trusted. Success with one or two cohorts is not sufficient to adopt a method of teaching. Ongoing evaluation is essential to eliminate cohort-related effects prior to implementation. It is not clear if the achieved results would be achievable in larger classes due to the reduction in student: lecturer ratio and limitation of class room time to allow all students to participate.

**Keywords:** *Simulation, Flipping the Classroom, Pharmacokinetics, Clean Room, Palliative Care, Peer Review*

## Introduction

Almost all higher education programs have components considered 'dry' and challenging in which to engage students and maintain interest. Teaching and the development of knowledge needs to address the needs of all the types of learner present in the class room environment. This classroom environment can be either a virtual online, a physical face-to-face or a mix. Students' ways of learning and participation vary, 'the activist' thrives on a challenge, 'the reflector' likes to research the answers before making decisions, the theorist is happier when things flow in a logical order whilst 'the pragmatist' likes to get straight to the point (Learning Styles Questionnaire, 2016).

Applying a mix of delivery methods such as didactic, practical, tutorial, simulation, role-play, problem-based and case-based learning scenarios or self-directed learning and flipping the class can satisfy the majority of students' learning needs (Knowles *et al.*, 2005; Learning Styles Questionnaire, 2016). However, the authors' hypothesis is that, using different methods in teaching and learning will also require a mix of assessment methods

such as Multiple Choice Questions (MCQs), Objective Structured Clinical Examination (OSCE), viva voce (oral examination), essay writing, and oral presentation or group work to further measure the success of the methods used in teaching and the outcome achieved demonstrated through students success (Knowles *et al.*, 2005). This has the potential to produce students who are "empowered to succeed."

Such an approach is simple to describe but it requires time and resources to develop, compared to delivering a lecture out of textbook or running a traditional practicum. A mixed approach of teaching and assessment was tested in four different units within the undergraduate pharmacy program where the content varied from foundation knowledge to applied knowledge and from first year to fourth year units within the program. In this university, 'units' are defined as the smallest credit-bearing component of a qualification that has been accredited by the university. A unit may also be called a 'module', 'subject', 'unit of competency' or 'accredited unit' in other institutions (Common Course Rules, 2016). Again in Charles Darwin University, any pharmacy units will

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cover several topics *e.g.* cardiovascular diseases, diabetes, arthritis, etc. or modules *e.g.* oncology, palliative care, paediatrics, etc. Within each unit evaluated, only one module was tested not the entire unit. All the units selected were those which are perceived as 'challenging' for students to engage with. Each unit will be discussed separately.

The projects were conducted to investigate the effect of engaging students into the learning process, and to measure how this may affect knowledge retention and achievement. Also, the effect of allowing students not only to take an active part in their learning process but also to take part in assessment of their peers. The hypothesis was that if students directed their energy to mastering knowledge rather than preparing for traditional exams they may become more engaged and participate better with their peers and in the learning process, leading to increased success. Project limitations were; firstly the class size, as our classes average 15 students and secondly that only one module in each of the four units was changed, not the entire unit.

The four units were Fundamentals of Pharmacy Practice, Advanced Pharmaceutics, Clinical Pharmacokinetics and Advanced Therapeutic (paediatrics, geriatrics, oncology and palliative care).

### **Aim**

The aim of the four projects was to improve students' engagement and success.

### **Method**

New teaching strategies such as flipping the class room, simulation, case and problem based learning, group activities and peer review were trialed to improve students' engagement and success with topics which, according to their feedback, were considered 'dry'. We flipped module/s or topics, used simulation and case or problem based learning; and group work to replace lectures. First, third and fourth year students were asked to prepare for the in-class activities at home using the lectures or simulation software. Innovative approaches were used for each of the four units, addressing the issue most identified by students as being lacking; engagement for first year students, simulation and flipping the class room for third year two units and the fourth year unit. Within Australia, as in many other countries, educational audits such as this are deemed not to require ethics approval. These were small pilot audits of the effect of applying what are established practices and techniques in education into new areas of the curriculum in order to improve the overall educational experience for the student.

### ***Process, results and evaluation of the four units***

#### **First year: Engagement**

The foundation units covers topics such as the basic skills in weighing and measuring, extemporaneous preparation

and how to use the dispensing computer program. They are also taught the Australian pharmacy regulations, the national health policy and guidelines, the structure and organisation of Australian health services, medical terminology and calculations. This unit is typically taught in the first year.

Firstly, after learning to weigh and measure, the usual white aqueous cream the students previously made was replaced by a "colourful aqueous cream" by using dark food colouring and aqueous cream adding visual appeal and facilitating assessment of adequate mixing. This makes the exercises fun but with a message of how using the right method of mixing can produce a safe product for the patient to use.

Secondly to develop medical terminology, Poll Everywhere™ (Chicago, USA), was used. This is an online poll questions system to collect instant, anonymous answers using mobile phones (SMS) and tablet devices(through the web), providing students the confidence to answer without the embarrassment of being seen to have been wrong, also allowing them to see how their knowledge compares with their peers. This proved effective and engaging.

Thirdly a proprietary dose-calculation computer game (IntelliLearn™, Adelaide, Australia) was used, which was perceived by the students as a good and enjoyable educational experience preferable to working through lists of practice calculations. The program presents the students with 3-dimensional coloured images of the actual pharmaceutical products, animated to allow addition or removal of liquids or tablets to make up the required dose or dilution based on the questions or the selection of correct product of certain strength or formulation. The program has a learning module that students can repeat as many times as they wish and an assessment module at the end. Finally, in week 11(the teaching semester is 12 weeks) students were divided into four groups of five students. Each group was allocated a case-study and three questions covering two topics out of those taught in the semester to prepare a 30 minutes revision session on the two topics and present this to the rest of the class; this was followed by 30 minutes questions time. In a four hours seminar they helped each other in completing revision of the entire unit, with excitement expressed and smiles on their faces during the session.

***Evaluation:*** While students' grades were not higher in the end of semester examination and compounding assessments when compared to previous year, students' participation and engagement was higher demonstrated by their 100% attendance and in-unit feedback (Table I). The unit evaluation had no negative comments and students indicated high levels of enjoyment in the unit.

#### ***Students' comments:***

##### **After the implementation of changes**

*"This unit improved my knowledge about the pharmaceutical system of Australia"* Student 1.

**Table I: Unit evaluation Pharmacy foundation**

Question	Before the changes	After the implementation of changes																				
The teaching of this unit is well organised	<p><b>Statistics:</b>                      Mean Response: 4.9                      Median Response: 5                      Standard Deviation: 1.5                      No. Valid Responses: 21                      % Broad Agreement: 62%</p> <p><b>Response Distribution:</b></p> <table border="1"> <tr><th>Count</th><th>Percent</th></tr> <tr><td>7, Strongly Agree</td><td>2 10%</td></tr> <tr><td>6</td><td>7 33%</td></tr> <tr><td>5</td><td>4 19%</td></tr> <tr><td>4, Undecided</td><td>6 29%</td></tr> <tr><td>3</td><td>0 0%</td></tr> <tr><td>2</td><td>1 5%</td></tr> <tr><td>1, Strongly Disagree</td><td>1 5%</td></tr> <tr><td>Not Applicable</td><td>0 0%</td></tr> <tr><td>No Response</td><td>0 0%</td></tr> </table>	Count	Percent	7, Strongly Agree	2 10%	6	7 33%	5	4 19%	4, Undecided	6 29%	3	0 0%	2	1 5%	1, Strongly Disagree	1 5%	Not Applicable	0 0%	No Response	0 0%	<p>7 Strongly agree 5 62.50%                      6 Agree 3 37.50%                      5 Somewhat agree 0 0.00%                      4 Neither agree nor disagree 0 0.00%                      3 Somewhat disagree 0 0.00%                      2 Disagree 0 0.00%                      1 Strongly disagree 0 0.00%</p> <p>Total 8</p>
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The delivery of this unit is sufficient for effective learning	<p><b>Statistics:</b>                      Mean Response: 4.8                      Median Response: 5                      Standard Deviation: 1.5                      No. Valid Responses: 21                      % Broad Agreement: 67%</p> <p><b>Response Distribution:</b></p> <table border="1"> <tr><th>Count</th><th>Percent</th></tr> <tr><td>7, Strongly Agree</td><td>0 0%</td></tr> <tr><td>6</td><td>9 43%</td></tr> <tr><td>5</td><td>5 24%</td></tr> <tr><td>4, Undecided</td><td>3 14%</td></tr> <tr><td>3</td><td>2 10%</td></tr> <tr><td>2</td><td>1 5%</td></tr> <tr><td>1, Strongly Disagree</td><td>1 5%</td></tr> <tr><td>Not Applicable</td><td>0 0%</td></tr> <tr><td>No Response</td><td>0 0%</td></tr> </table>	Count	Percent	7, Strongly Agree	0 0%	6	9 43%	5	5 24%	4, Undecided	3 14%	3	2 10%	2	1 5%	1, Strongly Disagree	1 5%	Not Applicable	0 0%	No Response	0 0%	<p>7 Strongly agree 5 62.50%                      6 Agree 3 37.50%                      5 Somewhat agree 0 0.00%                      4 Neither agree nor disagree 0 0.00%                      3 Somewhat disagree 0 0.00%                      2 Disagree 0 0.00%                      1 Strongly disagree 0 0.00%</p> <p>Total 8</p>
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The teaching stimulates my interest in this unit	<p><b>Statistics:</b>                      Mean Response: 5.2                      Median Response: 6                      Standard Deviation: 1.3                      No. Valid Responses: 21                      % Broad Agreement: 71%</p> <p><b>Response Distribution:</b></p> <table border="1"> <tr><th>Count</th><th>Percent</th></tr> <tr><td>7, Strongly Agree</td><td>2 10%</td></tr> <tr><td>6</td><td>10 48%</td></tr> <tr><td>5</td><td>3 14%</td></tr> <tr><td>4, Undecided</td><td>3 14%</td></tr> <tr><td>3</td><td>3 14%</td></tr> <tr><td>2</td><td>0 0%</td></tr> <tr><td>1, Strongly Disagree</td><td>0 0%</td></tr> <tr><td>Not Applicable</td><td>0 0%</td></tr> <tr><td>No Response</td><td>0 0%</td></tr> </table>	Count	Percent	7, Strongly Agree	2 10%	6	10 48%	5	3 14%	4, Undecided	3 14%	3	3 14%	2	0 0%	1, Strongly Disagree	0 0%	Not Applicable	0 0%	No Response	0 0%	<p>7 Strongly agree 5 62.50%                      6 Agree 3 37.50%                      5 Somewhat agree 0 0.00%                      4 Neither agree nor disagree 0 0.00%                      3 Somewhat disagree 0 0.00%                      2 Disagree 0 0.00%                      1 Strongly disagree 0 0.00%</p> <p>Total 8</p>
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The unit provides opportunities for participation and sharing of ideas	<p><b>Statistics:</b>                      Mean Response: 6.0                      Median Response: 6                      Standard Deviation: 0.9                      No. Valid Responses: 21                      % Broad Agreement: 90%</p> <p><b>Response Distribution:</b></p> <table border="1"> <tr><th>Count</th><th>Percent</th></tr> <tr><td>7, Strongly Agree</td><td>6 29%</td></tr> <tr><td>6</td><td>12 57%</td></tr> <tr><td>5</td><td>1 5%</td></tr> <tr><td>4, Undecided</td><td>2 10%</td></tr> <tr><td>3</td><td>0 0%</td></tr> <tr><td>2</td><td>0 0%</td></tr> <tr><td>1, Strongly Disagree</td><td>0 0%</td></tr> <tr><td>Not Applicable</td><td>0 0%</td></tr> <tr><td>No Response</td><td>0 0%</td></tr> </table>	Count	Percent	7, Strongly Agree	6 29%	6	12 57%	5	1 5%	4, Undecided	2 10%	3	0 0%	2	0 0%	1, Strongly Disagree	0 0%	Not Applicable	0 0%	No Response	0 0%	<p>7 Strongly agree 7 87.50%                      6 Agree 0 0.00%                      5 Somewhat agree 1 12.50%                      4 Neither agree nor disagree 0 0.00%                      3 Somewhat disagree 0 0.00%                      2 Disagree 0 0.00%                      1 Strongly disagree 0 0.00%</p> <p>Total 8</p>
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Overall, the assessment of the unit is fair	<p><b>Statistics:</b>                      Mean Response: 5.1                      Median Response: 5.5                      Standard Deviation: 1.6                      No. Valid Responses: 20                      % Broad Agreement: 75%</p> <p><b>Response Distribution:</b></p> <table border="1"> <tr><th>Count</th><th>Percent</th></tr> <tr><td>7, Strongly Agree</td><td>2 10%</td></tr> <tr><td>6</td><td>8 40%</td></tr> <tr><td>5</td><td>6 29%</td></tr> <tr><td>4, Undecided</td><td>0 0%</td></tr> <tr><td>3</td><td>2 10%</td></tr> <tr><td>2</td><td>1 5%</td></tr> <tr><td>1, Strongly Disagree</td><td>1 5%</td></tr> <tr><td>Not Applicable</td><td>1 5%</td></tr> <tr><td>No Response</td><td>0 0%</td></tr> </table>	Count	Percent	7, Strongly Agree	2 10%	6	8 40%	5	6 29%	4, Undecided	0 0%	3	2 10%	2	1 5%	1, Strongly Disagree	1 5%	Not Applicable	1 5%	No Response	0 0%	<p>7 Strongly agree 5 62.50%                      6 Agree 3 37.50%                      5 Somewhat agree 0 0.00%                      4 Neither agree nor disagree 0 0.00%                      3 Somewhat disagree 0 0.00%                      2 Disagree 0 0.00%                      1 Strongly disagree 0 0.00%</p> <p>Total 8</p>
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The feedback on my work is provided promptly	<p><b>Statistics:</b>                      Mean Response: 5.0                      Median Response: 5                      Standard Deviation: 1.5                      No. Valid Responses: 21                      % Broad Agreement: 71%</p> <p><b>Response Distribution:</b></p> <table border="1"> <tr><th>Count</th><th>Percent</th></tr> <tr><td>7, Strongly Agree</td><td>3 14%</td></tr> <tr><td>6</td><td>5 24%</td></tr> <tr><td>5</td><td>7 33%</td></tr> <tr><td>4, Undecided</td><td>4 19%</td></tr> <tr><td>3</td><td>0 0%</td></tr> <tr><td>2</td><td>1 5%</td></tr> <tr><td>1, Strongly Disagree</td><td>1 5%</td></tr> <tr><td>Not Applicable</td><td>0 0%</td></tr> <tr><td>No Response</td><td>0 0%</td></tr> </table>	Count	Percent	7, Strongly Agree	3 14%	6	5 24%	5	7 33%	4, Undecided	4 19%	3	0 0%	2	1 5%	1, Strongly Disagree	1 5%	Not Applicable	0 0%	No Response	0 0%	<p>Average 6.50                      Theme Avg. (Pharmacy) 5.12                      School AVG. (NTU_NTY_PC) 5.24                      University AVG. 5.33</p>
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Overall		<p>Average 6.52                      Theme Avg. (Pharmacy) 5.67                      School AVG. (NTU_NTY_PC) 5.51                      University AVG. 5.61</p>																				
It was made clear what is expected of me		<p>Average 6.63                      Theme Avg. (Pharmacy) 5.54                      School AVG. (NTU_NTY_PC) 5.38                      University AVG. 5.44</p>																				

“The structure and learning outcome make this unit very easy to follow what is required to know for the final examination” Student 2.

“Interesting and stimulates people to study” Student 3.

**Before the implementation of changes**

“These topics can be very dry and hardly engaging” Student 1.

“Why do we need a full unit to just learn that” Student 2.

**Third year: Simulation**

The clean room simulation was first tested in 2013 and re-evaluated in 2014; and was fully implemented as part of the curriculum in 2015. Simulating the aseptic and

cytotoxic dispensing processes prepares students with the core skills to work in a clean room suite after being formally validated later in their workplace (Common Course Rules, 2016). The rationale for introducing this module was to enable students to understand the concept of working in a clean room environment (both aseptic and cytotoxic), working in a simulated laminar airflow hood and environment rather than in the classroom through a lecture (Morrissey & Ball, 2014). This module is delivered as a series of practical classes with tutorials on the theory of parenteral formulations and the necessary pH and osmolality calculations related to parenteral admixtures. This extends on to administration guidelines and how to determine compatibilities with infusion fluids and administration sites. Total parenteral nutrition (TPN) for adults and neonates and the required calculations are

practised, and then the “do not rush to crush” theory for medication administration via enteral feeding tubes.

Students’ were for the first time able to use and identify infusion fluids, syringes, needles, ampoules, vials; and understand the removal of particles and organisms with in-line filters. Each student manufactured two TPN bags, one for an adult and one for a neonate, two infusion bags with cytotoxic (placebo) or aseptic admixtures and five preparations for enteral feeding. They also learned how to manufacture eye drops in an aseptic environment and adjust pH and osmolality. Their successful application of aseptic techniques was confirmed with contact agar plates and broth transfers.

This module covered policies and standards, working in a laminar airflow work station, clean-rooms; personal protective equipment, cleaning before and after dispensing in the clean room, preparation of products, waste management, labelling and packaging and reasons for exclusions from working in clean room and cytotoxic preparation.

**Evaluation:** All students except one who failed to attend the final examination, passed the unit with grade distribution superior to that prior to 2013, from 0% high distinction, 10% distinction and 10% credit, 60% pass and 20% fails to 10% high distinction, 10% distinction, 30% credit, 40% pass and 10% fails. Students reported that the clean room simulation was an ‘unforgettable’ and ‘enjoyable’ experience, this feedback was consistent in 2013, 2014 and 2015.

#### **Students’ comments:**

*“The practicals are a good way to apply your skills and knowledge learnt in lectures. It was good to do the activities in the workshops on Fridays as it helped with problem solving skills”* Student-1.

*“lecture, practicals and workshops are great way of learning calculation questions or case studies especially the drug compatibility exercise were very interesting”* Student-2.

*“TPN practicals were good and helped with our theory learning. The assessment pieces contributed to my understanding of the unit. It was good that a realistic product form was used for practicals products instead of long and pointless practical reports”* Student-3.

### **Third year: Simulations and Flipping the Classroom projects**

#### **Project 1**

In pharmacokinetic classes, a variety of activities and technologies were applied. These included PowerPoint™ slides, and Poll Everywhere™ quizzes, computer simulation programs to calculate pharmacokinetics parameters and simulate the results by plotting into graphs, massive open online course (MOOC) video and in-class group problem-solving and calculations. Students were provided with all lectures, textbook and a CD which

contained the entire lecture content, problems and the simulation program. This was to enable students to prepare for each class at home. Then in class the lecturer provided quick revision of material and formulas during the 30 minutes, followed by calculations and problem solving for the rest of the class (90 minutes). This was conducted twice a week.

#### **Project 2**

In the first week of the semester, students were provided with list of medications which have a therapeutic drug monitoring requirement to select one for individual oral presentation. For ten weeks they continued to apply the theory they were learning each week to their drug. This led to oral presentations and a written report on their selected medication, covering the drug’s pharmacokinetic and pharmacodynamic profile. Presentations were at a show-case all day seminar, at week 11. Presentations were peer-reviewed using a rubric provided at the beginning of the semester to guide preparation of their drug profile. The lecturer also marked the work. Twelve drug profiles were taught to the students by the 12 students, slides and reports were made available to all students after the presentations concluded as study resources. This opened dialogue between the students during the semester, as each of them became the expert on that drug. This was an extremely positive outcome as communication was extended to all the topics of the unit not just that drug. All the medications presented were included in the final exam.

**Evaluation:** This approach, plus the use of technology and simulation (Health Workforce Australia, 2010; Weinger, 2010; Weller *et al.*, 2012; Hedaya, 2012) made an otherwise very dry topic, fun and enjoyable. Students’ results in the final examinations improved when compared to previous year (100% pass in 2015, 94% pass in 2014, 86% pass in 2013 of all students submitted the final examination).

Students’ feedback was that the unit is taught in a “less threatening environment” as they practiced all types of assessment questions during classes.

#### **Students’ comments:**

*“Combination of lecture, tutorial with PK software provided more than adequate learning resources”* Student 1.

*“Allows for studying at own pace”* Student 2.

*“The assigned textbook was really helpful when studying for calculations as it provided the answers for the example questions. The CD that came with the textbook was also helpful as it reinforced the concepts learned in lectures. The online videos also helped to reinforce the information that was taught in lectures”* Student 3.

*“The individual drug assignments where a good assessment and the whole day allocated to the presentations were interesting and helpful”* Student 4.

#### **Fourth year: Mixed Approach, Case Study Based-learning and Flipping the Classroom**

Another problem unit was an integrative therapeutics unit pulling together gender-specific conditions, life stages (paediatrics/geriatrics) and palliative care. This unit was found to be emotionally stressful for many students, not only on personal level but also as it is taught in the final semester of their degree where students are already stressed.

The national palliative care program, Palliative Care Curriculum for undergraduates (PCC4U™ Brisbane, Australia) (Palliative Care Curriculum for Undergraduates 2012; 2015) is primarily designed for medical and nursing students. Traditionally pharmacy students were only introduced to the topic over two hours of lectures. In line with moves towards interdisciplinary learning the unit coordinator applied the PCC4U content with modifications to suit pharmacy students. The same cases were used but each patient in those cases was given a medications history. Students were paired in week-1: each pair, self-directed, studied one module or topic out of the eight offered in the online curriculum, and conducted a full medication review for the patient in the scenario from the treatment they hypothetically should be receiving at the time of choosing palliative care over treatment for cure. The medication reviews were to establish which medication should be ceased, and which medications should continue or should be introduced and why. Students then taught the topic they had studied to the rest of the class through their case, in a “grand round” style seminar. All students, six pairs, presented over one day in week 11, then peer reviewed each other’s using a rubric provided to them in week one. The slides and reports were made available to all students after the presentations concluded as study resources. All topics presented were included in the final exam.

**Evaluation:** All students enrolled in this unit passed the palliative care module and the unit, except for one person absent from the final examination. After the publication of the students’ grades, students provided anonymous feedback as shown in Table II and also completed the Learning-Styles-Questionnaire by Honey-and-Mumford (Learning Styles Questionnaire, 2016). In the Course Advisory Group meeting in 2015; the current and previous students’ representatives commended the way this module was delivered. One student decided to undertake work experience in the palliative care ward of a public hospital as he believed that this would be an interesting work area for pharmacists which can be professionally satisfying.

#### **Discussion**

Using multiple methods of teaching delivery allowed the diverse types of learners to actively participate and improved their satisfaction rating of the unit content.

This assumption was made based on the Learning-Styles-Questionnaire by Honey-and-Mumford, completed by 4<sup>th</sup> year students, and their comments. Those who

**Table II: Palliative Care Curriculum for Undergraduate (PCC4U) presentations pharmacy students’ evaluation**

PCC4U Evaluation Questions	<8/10	>8/10
How new was this material to you?		12
How easy was it to understand?	2	10
How relevant was the content for pharmacists	1	11
<b>What do you think was the strength of the course?</b>		
<ul style="list-style-type: none"> <li>- Variety of learning materials written and videos</li> <li>- Regular revision in the class is really good</li> <li>- Great cases and videos, useful method for learning</li> <li>- Very well set out, I learnt a lot through these modules</li> <li>- I now understand patient and their families’ need and the difference between treatment to cure and treatment to relieve symptoms</li> <li>- Very well structured, interactive and improved my knowledge about oncology and palliative care</li> <li>- Content available online, extensive information and resources, the flashdrive provided was also very useful</li> <li>- Lots of supportive materials, easy to locate and research the topics</li> <li>- Interaction and communication with the lecturer was very important, reduced the stress , it was friendly approach helped me to study effectively without stress, I wish all therapeutics units are like that</li> <li>- Great information and references</li> </ul>		
<b>What you consider be the weaknesses of the course?</b>		
<ul style="list-style-type: none"> <li>- More than two people in the group would be good</li> <li>- Some aspects were difficult to understand as I never met real palliative patient</li> <li>- It took some time to understood the assessment</li> <li>- Emotional topics, but I understand we have to learn them</li> <li>- I think announcement to tell us the timeline would have been good to keep on track</li> <li>- The cases are provoking, but it is oncology and palliative issues after all</li> </ul>		

categorised themselves as predominantly reflectors, elected lectures and workshops as best teaching and written short answers questions as their preferred method of assessment. Those who were predominantly theorist elected tutorial or workshops where they can ask questions as best teaching and written examinations their preferred method of assessment. Those who were predominantly pragmatists elected workshops and tutorial where they can learn from the way others think as best teaching and practicums as their preferred method of assessment. Those who were predominantly activists elected practicums and problem based learning as best teaching and oral examinations or practicums as their preferred method of assessment. Accordingly tutorials and workshops were the preferred for all types as learning method.

When the students were engaged in the teaching process, it was observed that their engagement with each other’s presentations was higher than traditional lecturer presentations. Including the topic the students delivered in the unit assessment made it a real task and responsibility for the students to learn the topic very well themselves first before presenting. They also read about the topics and asked questions when other students were presenting, as they now perceived they had real need to know in order to be able to answer the examination questions later on. While the grade and number of students passing the units were either the same or only

slightly improved, this may suggest that engaging students in the learning process improves competence and engagement rather than grades, as the reduction in fails was higher than the increase in grade distribution in all units.

The students who were enrolled in those units were a mix of domestic and international students and from broad age group. While some students find it intimidating to present to the class, the majority of students reported that the activities boosted their confidence to speak which was noticed by other lecturers in other units, especially during their oral competencies and examinations. Being part of the assessment experience gave them a better understanding of how they are assessed by academic staff and where and why they did or did not do well and where they need to improve, directing their energy to mastering knowledge rather than just passing the next assessment.

The lecturer workload was not reduced, as to ensure that the content of the topics delivered by the students were complete and correct, topic objectives and salient points were developed and supplied to the students, and then were re-enforced by the lecturer at the end of their presentations.

As much as the pharmacist's skill of relaying information to patients is important, the accuracy of the information presented is paramount and it was essential to test the level of that knowledge, however the method of testing does not have to be traditional written examinations in a profession heavily depended on oral communication with patients and the healthcare team members.

### Limitations

Our largest class was the first year 21 students the other three classes were 12-15 students each, it is not clear if student satisfaction, staff numbers and over all sustainability could be achieved in larger classes.

The flipping the classroom, simulation, and competency-based learning were tested and compared between two cohorts or more (2013, 2014 and 2015). Reproducibility is the most important part of the experiment to confirm if the results can be trusted. These approaches improved experiences in "challenging" topics.

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