

# CAUTIOUSLY IMPLEMENTING TEAM TEACHING: A REFLECTION ON A PILOT TEAM TEACHING COURSE

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## BACKGROUND

The practice of collaborative teaching is increasing in universities, especially in interdisciplinary programmes. While collaborative research is encouraged (and at times the norm), collaborative teaching is not as prevalent. Where collaborative teaching is practiced, the nature and extent of collaboration differs. Hence, when moving away from the traditional lecture format where course content is imparted by a single lecturer, there is a need to understand the institutional implications of adopting alternative teaching models such as co-teaching or team teaching. This article is based on our experiences and reflections in adopting these alternative teaching models to teach eight modules in the Lee Kuan Yew School of Public Policy's (LKY SPP) Master of Public Policy Programme over two academic years. It compares team-taught and co-taught modules in the programme which are related to interdisciplinary topics<sup>1</sup>.

### *What is team teaching?*

Based on our experience, we conceptualize **co-teaching** as a teaching model where instructors share the module's teaching load, either equally or as per mutual understanding, but do not actively engage in each other's class or address the class together. In contrast, we define **team teaching** as an active collaboration between instructors, starting from the module design stage to the delivery of the material in the classroom.

## CONTEXT

Our definition draws upon our experience at LKY SPP, where core modules of the Master of Public Policy Programme have moved away from being single faculty-taught to team-taught modules by two to three faculty. The assumption is that team teaching may foster deeper learning compared to single-taught courses (Anderson & Speck, 1998; Carpenter et al., 2007; Crow & Smith, 2003).

### *Rationales for team teaching*

The impetus for implementing team teaching at the LKY SPP stems from various rationales that reinforce each other:

1. To facilitate the integration of junior faculty with little teaching experience
2. To capitalize on complementary expertise between faculty within a similar area of expertise
3. To enable students to understand public policy from various schools of thought, such as an economic, political and institutional perspective, which is necessary in some inter-disciplinary courses

With respect to the first rationale, as discussed later, there is a need to exercise caution such that no faculty within the team would 'overshadow' another, but instead work on an equal footing where all members of the team would learn from each other. Regarding the second rationale, student evaluations have shown that because of the complementary expertise different faculty bring to the team, team-taught courses provide students with the opportunity to be exposed to diverse points of view. Finally, for the last rationale, team teaching would enable students to look at complex public policy problems from different disciplinary perspectives, understand the pros and the cons of analytical tools, or build argumentation by utilizing different data sources and information.

## IMPLEMENTING TEAM TEACHING

These team-taught core modules occur in the first year of the two-year programme, and constitute about 25 percent of the total number of modules. The total enrolment for the programme is about 60, comprising mainly international students. After two years of implementing team-taught modules, a new team of instructors would be put together for each module, to facilitate continuous innovation and experimentation.

### *Intended learning outcomes*

The main learning outcomes of these core modules are to enable students to adopt an integrative approach to public policy analysis through various disciplinary approaches such as economics, politics, and development studies. Our team teaching approach implies that instructors work as a team to design the learning objectives of the module, planning all assignments, and assessing students' work as integral components of team teaching. Holding post-class debrief meetings is also crucial to team teaching, ensuring continuous interaction and dialogue between instructors.

Implicitly, the adoption of a team-taught approach assumes that the learning outcomes of students in team-taught classes are reached more significantly than those taught by a single instructor. However, in order to test this proposition, a comparison group would be required. The available evidence from the literature tends to focus on the advantages and disadvantages contrasting between common collaborative teaching models (Dynak, Whitten & Dynak, 1997), as summarized in Table 1. In the context of the LKY SPP, a combination of complementary, parallel and co-teaching approaches are used.

Table 1  
*Collaborative teaching models: Features, advantages, and disadvantages*

<b>Collaborative Teaching Models</b>	<b>Features</b>	<b>Advantages</b>	<b>Disadvantages</b>
<b>Alternative</b>	Re-teaching or extension of the lesson by a supporting instructor beyond the classroom. This is common in courses that require laboratory sessions or computer-aided instruction, such as learning software associated with the course.	This model can be adopted for 'hard skills' or technical courses to enable smaller groups to interact with an instructor. It is a common model when the main instructor works with a team of teaching assistants.	Variability in teaching quality between joint instructors may lead to students opting to attend sessions conducted by the more experienced instructors, resulting in larger classes than initially intended. When class sizes are restricted (e.g. due to the number of computers available) close monitoring of students is necessary.
<b>Complementary</b>	When a supporting instructor in the classroom assists students during or after the lesson. A typical application of this model is when the lead instructor is involved in teaching the core concepts and gives in-class assignments. Meanwhile, the supporting instructor walks around in class to help students apply the concepts to the assignments.	This can be done any time the class involves small group discussions, where several instructors can informally join groups and call on each other to answer specific questions. Students might have a better appreciation of differing views. Also enable instructors to have a better understanding of the areas that need further reinforcement in subsequent classes.	The teaching team needs to ensure that students are aware that different instructors co-teaching the module may give different advice, especially in the context of assignments, where there are many ways to solve a particular problem. Students need to have a certain degree of openness and maturity to be able to function well in this context.
<b>Parallel</b>	When the class is split into smaller groups to reduce the student-instructor ratio and facilitate closer student-instructor interaction.	This allows for the use of more than one case study or 'problem', where students may choose which topic interests them the most, or is most relevant to their professional objectives.	Disadvantages are similar to the "Alternative" model, and may be further amplified in the context of 'soft skills' teaching, where the ability and experience of instructors in imparting such knowledge may be more variable.

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Co-teaching	When the instructors share the teaching load based on their areas of knowledge. There may or may not be joint module planning and design. Usually the instructors would run their assigned sessions independently without the other instructor(s) being present in class.	Less time consuming for instructors in terms of coordination and grading. Administratively, this is a useful model when instructors have travel or other professional obligations, e.g. co-teaching can be on alternate weeks, alternate months, or simply by dividing the semester in two parts.	Students may perceive a lack of integration in the syllabus. Attention must be paid on the sequencing of instructors, so it fosters an appropriate learning journey, building on the scaffolding done earlier. There is potential for faculty to underestimate the need for coordination.
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**Source:** Dynak, Whitten, and Dynak (1997)

### ***Evaluating the impact of team teaching***

Experimental studies would be ideal to measure the impact of team teaching. However, it would require careful logistical planning as well as significant resource allocation. In programmes where total enrolment numbers are small, such as this graduate level programme offered by the LKY SPP, splitting the cohort for an experimental evaluation might be impossible. Measuring the impact would require tracking the students for a reasonably long period of time so that a change in learning outcomes is actually observed. Semester-long courses might not be conducive for these reasons, and year-long courses are not a norm in most departments. Further, with several departments emphasizing student diversity, identifying well-balanced treatment and control groups can be challenging, and this would have direct implications for the validity of results from the experimental evaluation.

## **LIMITATIONS OF TEAM TEACHING AND LEARNING POINTS**

### ***Ensure clarity and coherence of teaching approach and materials between faculty members***

While there are definite advantages to team teaching, it is not without its disadvantages. For the students, team teaching could lead to more confusion than clarity on the material if the perspectives of instructors within the team are too conflicting (Buckley, 2000). It may also lead to confusion among students over who might be the “lead faculty” for the entire module and they may not know which instructor to approach or communicate with to clarify doubts outside the classroom. From the faculty standpoint, preparing for a team-taught module is certainly more challenging than preparing for single-taught modules. Specifically for our module, we spent a significant amount of time designing the syllabus, assignments, and exchanging feedback on lecture notes. This heavy investment in preparation time could be a concern especially to tenure track faculty, who must strike a balance between teaching and research.

### ***Recognition of a different and preferred approach by the university administration***

At the administrative level, we draw the following conclusions: Firstly, when opting for team teaching as an appropriate pedagogic method for a module, the administrators must be clear that this is preferred over a single taught module. Secondly, the team members' composition must be carefully selected to ensure complementarity, and equity and fairness between group members. Thirdly, administrators should recognize the workload involved in team teaching, which requires acknowledgement, in terms of the overall teaching load. This may become problematic especially when faculty are involved in multiple team-taught courses, due to the time required for coordination purposes.

For faculty on tenure track, training for team teaching can add to the existing burden of balancing research and teaching. As a result of these experiences, at the LKY SPP, there is appropriate teaching load credit for team-taught courses. A point to consider for administrators would be whether to engineer team teaching or let teams form organically over time. At the LKY SPP, teams are assigned by the School's management, and the rotational nature of teams at the LKY SPP after two years of teaching gives room for individual faculty to adapt and learn from each other, as well as strengthen the teams. Faculty who collaborate on research projects can also team up to teach, allowing them to bring in insights from their research into the classroom.

### ***Provide training or mentorship for faculty members new to team teaching***

In addition, just as new faculty usually takes part in training as they engage in teaching in their first years, some type of training should also be considered for team teaching. The content of such training should include a discussion on the various modes of team teaching and the value in mixing these models. The importance of forging good relations between members of the team is essential. As such, the training described above can partly serve as a 'warm up' for new teams.

### ***Develop indicators to measure team teaching***

Thompson-Whiteside (2013) raises questions about standardized evaluations of teaching and learning. As frameworks are being drawn to ensure quality of teaching and students' learning, and in order to benchmark institutions, these tend to take a more quantitative stance, in order to obtain more 'precise' and comparable measures. This trend may pose challenges for collaborative teaching, which involves a more complex set of interactions, and is challenging to quantify using standard measures that apply more to single taught courses. This reinforces the need to develop specific measures to assess collaborative teaching, so that the indicators reflect the diversity of teaching models used, and calls for the use of qualitative measures that could be used within a comparative perspective.

Developing such indicators requires further research, contrasting systematically student feedback (both qualitative and quantitative) in single taught courses versus co-taught or team-taught courses within the same field, or through the use of a control group within an experimental design. Given the internationalization of higher education, the expansion of partnerships across countries (via double degrees and exchange programs), we believe that this will be an increasingly important area of higher education management and deserves further research.

## CONCLUSION

In conclusion, the benefits of team teaching can go beyond learning outcomes for students, as they see the team work together, and interact with both faculty in class. Extensive interaction tends to work better for class size of less than 40 students. It is also crucial that the faculty communicates clear expectations and deliverables together.

After more than three years of implementation, there is now a recognition that team taught courses are equivalent to a full course teaching load and faculty gets credit accordingly. However, it is still unclear how standardized student evaluation forms reflect the team-based aspect of teaching. Team teaching can be enriching but also more challenging (and time-consuming) than co-teaching, where only one faculty is in the classroom at a given time. Finally, team teaching requires a cautious and reflective approach to teaching, and one that respects professional growth of all team members.

## ENDNOTE

1. The Authors would like to thank CDTL for a teaching enhancement grant that allowed us to look into this issue of team teaching and reflect on our institutional practices. A lengthier version of this paper was presented at the Fifth Asian Conference on Education in Osaka, Japan, in 2013. We thank the participants as well as CDTL staff for their valuable comments.

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# STUDENT PERCEPTIONS AND ATTITUDES TOWARDS THE FLIPPED CLASSROOM APPROACH IN A PHARMACEUTICAL FORMULATION AND TECHNOLOGY MODULE IN NUS

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## INTRODUCTION

The NUS Pharmacy curriculum is geared towards producing well-trained community and hospital pharmacists who play active roles in managing their patients' health through the appropriate use of medicinal products. As medicinal product experts, pharmacists should leverage on their knowledge of product design to make the best treatment recommendations. However, in recent years, it was observed that students often could not draw the link between drug product design and use, despite a strong grounding on the former through compulsory formulation and technology modules. This may be attributed to insufficient opportunities for the students to discuss and apply the knowledge acquired. Hence, there is a need to improve knowledge integration in these areas.

It has been envisioned that adopting a flipped classroom approach may potentially bridge this gap (Tune, Sturek, & Basile, 2013; Freeman et al., 2014). In the flipped classroom approach, students undertake independent learning of prescribed materials, such as lecture slides, videos and reference books, outside of class. When they meet their instructor and peers face to face in the classroom, they engage in discussions of the material learnt. This leads to a change in the classroom dynamic, from being traditionally passive and teacher-centric to an active, student-centric learning environment with teachers assuming the role of facilitators. Some key benefits of the flipped classroom approach include allowing students to learn at their own pace and convenience, as well as providing more opportunities for student-teacher and student-student interaction, both of which promote higher-order learning (Moraros, Islam, Yu, Banow, & Schindelka, 2015).

The literature abounds with examples of how the flipped classroom approach has improved student learning outcomes in many disciplines (van Vilet, Winnips, & Brouwer, 2015; Strayer, 2012). To date, this approach to teaching and learning is relatively new to the Department of Pharmacy. Hence, this pilot study was carried out to explore the feasibility of implementing the flipped classroom approach in a

pharmaceutical formulation and technology module taken by 199 undergraduates in their second year of study. It was hoped that this approach would provide students the opportunity to effectively apply their knowledge of drug product design in actual practice. The ultimate aim is to develop independent learners with critical thinking skills.

The topic of “Suppositories” was selected for this pilot study. This topic focuses on the formulation, production and evaluation of suppository products. Short video lectures were developed to address these three aspects of suppositories, and the videos were subsequently uploaded to an online platform (IVLE) for students to view over a span of three months. To meet the objective of knowledge integration, the face-to-face sessions were designed to enable students to apply their knowledge of the formulation, production and evaluation of suppositories in the development of anti-malarial suppositories, demonstrated to be of value in reducing the incidence of malaria-related deaths in African children. As this was the inaugural attempt of implementing the flipped classroom approach in this module, a survey was carried out to evaluate student attitudes and perceptions towards this new teaching approach.

## STUDY DESIGN

### Video lectures

Six video lectures, each lasting between 10 to 20 minutes, were created using a screen recording software equipped with video editing functions (Camtasia<sup>®</sup> for Mac). A summary of the videos’ content can be seen in Table 1.

Table 1

*Content of the short videos produced on the topic “Suppositories”*

Title of video	No. of videos	Content
Introduction	1	<ul style="list-style-type: none"> <li>• Definition and rationale for the use of suppositories</li> <li>• Advantages and disadvantages of using suppositories</li> </ul>
Formulation	2	<ul style="list-style-type: none"> <li>• Formulation of suppositories</li> <li>• Characteristics, advantages and disadvantages of different suppository bases</li> </ul>
Production	1	<ul style="list-style-type: none"> <li>• Laboratory scale methods for production of suppositories</li> <li>• Large scale production of suppositories (selected example)</li> </ul>
Evaluation	2	<ul style="list-style-type: none"> <li>• Different methods employed to evaluate the quality of suppositories</li> </ul>

The total time of all 6 video lectures was approximately 1.5 hours. To improve student engagement and sustain their interest, timely animations highlighting important points, video snippets of practical experiments, music, as well as clear voice-over narration were incorporated in the video lectures. Students also received the lecture slides, complete with the video script.

### Face-to-face sessions

The entire class, which consisted a total of 199 students, was divided into 7 groups, each group comprising a maximum of 30 students. Accordingly, 7 face-to-face sessions were scheduled, with each session lasting 90 min. These face-to-face sessions were organized as a follow-up to the video lectures, that is, students attended these sessions after the 3-month period allocated for them to view the video lectures. During this

3-month period, students attended traditional lectures for the other topics in the module, over and above the video lectures on Suppositories. There were no formative assessments conducted but consultations were readily available to the students.

For each face-to-face session (up to 30 students per session), students were further divided into 5 discussion groups, where each group had to work on assigned questions and give a presentation of their answers. Questions were set to enable students to apply the material learnt from the video lectures to the formulation, production and evaluation of suppositories for the treatment of malaria. The way each session was structured is detailed in Table 2. The same content was covered for all 7 face-to-face sessions.

Table 2  
*Example of the structure of a face-to-face session*

Time	Content covered
0-10 min	<ul style="list-style-type: none"> <li>• Introduction and objectives of the session</li> <li>• Background information about malaria and its route of transmission</li> <li>• Rapid disease progression in complicated malaria resulting in many deaths of children in rural villages of Africa</li> <li>• Current treatment options for malaria using oral anti-malarial agents and the limitations of oral therapy in complicated malaria</li> </ul>
10-20 min	<ul style="list-style-type: none"> <li>• Recent success of anti-malarial suppository formulations delaying progression of complicated malaria and preventing deaths</li> <li>• Application of suppository formulations to overcome the problems associated with oral anti-malarial agents</li> <li>• Limited research on the suppository formulations of anti-malarial agents despite its life-saving potential</li> </ul>
20-30 min	<ul style="list-style-type: none"> <li>• Discussion on a recent research article entitled: Self-microemulsifying suppository formulations of artemether (an anti-malarial agent)</li> <li>• Objectives of the study and experiments performed to evaluate the physical characteristics and drug release profiles of the 2 formulations of anti-malarial suppositories investigated</li> <li>• Some questions posed to students on the article: <ul style="list-style-type: none"> <li>▪ What is the meaning of self-emulsifying?</li> <li>▪ How did the 2 different formulations of suppositories disintegrate and release the drug?</li> </ul> </li> </ul>
30-50 min	<ul style="list-style-type: none"> <li>• Group discussions on the following questions (each group is allocated 1 question): <ol style="list-style-type: none"> <li>1) What are the advantages of developing suppository formulations of artemether?</li> <li>2) How do you think the suppositories were prepared? Briefly describe the steps involved, starting from the raw materials.</li> <li>3) What are the fundamental differences between theobroma oil and the emulsifying lipid base employed in this study? How does this impact drug release?</li> <li>4) What is the apparatus suitable for the determination of the drug release properties of the suppositories? Briefly discuss how this test is carried out.</li> <li>5) Which formulation do you think will release the drug faster? Why?</li> </ol> </li> </ul>
50-90 min	Informal group presentations of their answers and summary of discussions

## Student survey

After each face-to-face session, a paper-and-pen survey comprising a total of 10 statements was administered to the students to obtain their feedback on specific aspects of the flipped classroom approach (Table 3). Students responded to the statements based on a 5-point Likert scale (“Strongly Disagree”, “Disagree”, “Unsure”, “Agree”, and “Strongly Agree”). Prior to attempting the survey, students were asked to indicate the number of videos they had watched at home. Students could also provide qualitative comments at the bottom of the survey form.

Table 3

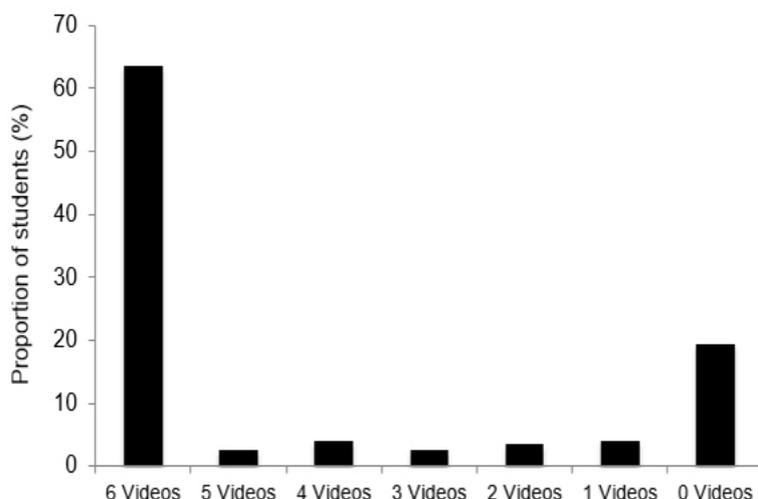
### List of statements in the survey form

Aspect of flipped classroom approach	Statements
Video-based teaching and learning	<ol style="list-style-type: none"><li>1. The pace and content of the video lectures were appropriate for self-learning at home.</li><li>2. Flipped classroom increased my workload as I had to learn the topic on my own and prepare for discussion.</li><li>3. The flipped classroom approach allowed me to learn at my own pace and convenience which was beneficial.</li></ol>
Face-to-face session	<ol style="list-style-type: none"><li>4. The flipped classroom approach reinforced the content covered in the video lectures and made me see how the knowledge is relevant and applicable in real life.</li><li>5. The flipped classroom approach created opportunities for student-student interactions that promoted learning.</li><li>6. The flipped classroom approach has increased my interest in the topic that was taught this way.</li><li>7. I feel less engaged when topics are taught via the flipped classroom approach compared to the traditional method of teaching.</li></ol>
Overall view on flipped classroom teaching and learning	<ol style="list-style-type: none"><li>8. I would like to see the flipped classroom approach in teaching be applied to other (only selected) topics in this module.</li><li>9. Overall, flipped classroom approach was a positive experience for me and I reaped additional educational benefits compared to the traditional lecture.</li><li>10. Overall, I still prefer the traditional lecture over the flipped classroom approach.</li></ol>

## RESULTS AND DISCUSSION

### *Response rate and number of videos watched by students*

In total, 195 students (or 98%) responded to the survey. The high response rate was likely due to the fact that the paper-and-pen survey was administered immediately after each face-to-face session. The 4 students who did not participate in the survey were either absent or left before the session ended.



*Figure 1.* Bar chart showing the number of videos watched by the 195 respondents.

Overall, the number of videos respondents watched varied between zero to six, with more than half (63.6%) who watched all six videos (Figure 1). A small proportion of students (38 out of 195 respondents or 19.5%) indicated that they did not watch any of the uploaded videos. Amongst these respondents, 6 of them commented that reading the accompanying video scripts was sufficient, and one commented that he/she could not watch the videos but no reasons were provided. The remaining 17% of the 195 respondents watched between 1 to 5 videos.

After analyzing the survey results, it was observed that there was no correlation between the number of videos respondents watched and their responses to the statements in the survey. The data showed that the number of videos the respondents watched did not appear to have any bearing on their responses to the survey statements. For example, it did not mean that respondents who had watched more videos felt that the flipped classroom approach increased their workload and vice versa. Hence, the data presented in the next section (Figures 2a to 2j) represents the responses from all 195 respondents regardless of the number of videos they had watched.

In the following section, to keep things simple, the responses for “Strongly Agree” and “Agree” were summed up and discussed collectively as agreeing with the respective statement. Likewise, the responses for “Strongly Disagree” and “Disagree” were summed up and discussed collectively as disagreeing with the respective statement.

## Feedback on video-based teaching and learning: Statements 1 to 3

Based on the survey results, there was positive student feedback towards the flipped classroom approach.

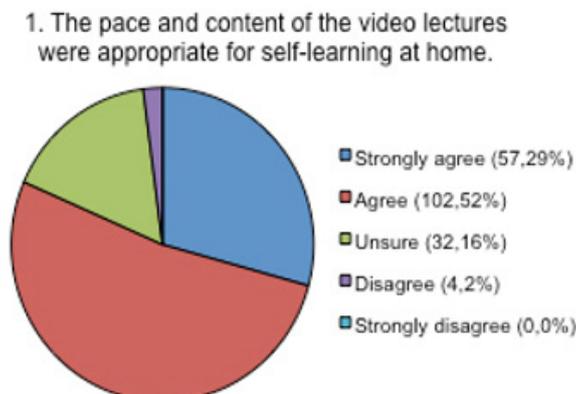


Figure 2. Responses of students to Statement 1 in the survey.

For Statement 1 (see Figure 2), 159 respondents felt that the pace and content of the video lectures were appropriate for self-learning at home [with 102 (52%) and 57 (29%) respondents indicating that they “Agree” and “Strongly Agree” respectively]. Meanwhile, 4 out of the 195 respondents (or 2%) indicated they disagreed and 32 (or 16%) indicated that they were “Unsure”. 26 out of the 32 respondents who had indicated they were “Unsure” about Statement 1 did not watch any of the videos at all, and as expected, they were unable to gauge if the pace of the videos were appropriate.

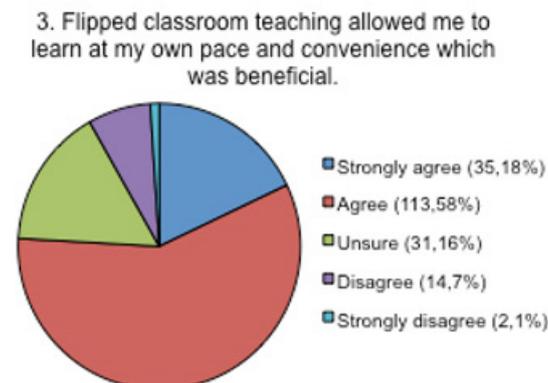


Figure 3. Responses of students to Statement 3 in the survey.

Meanwhile, 148 respondents agreed with Statement 3 (see Figure 3), that the flipped classroom approach allowed them to learn at their own pace and convenience which they found beneficial [with 113 (58%) and 35 (18%) respondents indicating that they “Agree” and “Strongly Agree” respectively]. 31 respondents (or 16%) indicated they were “Unsure”, and 16 respondents (or 8%) disagreed with Statement 3.

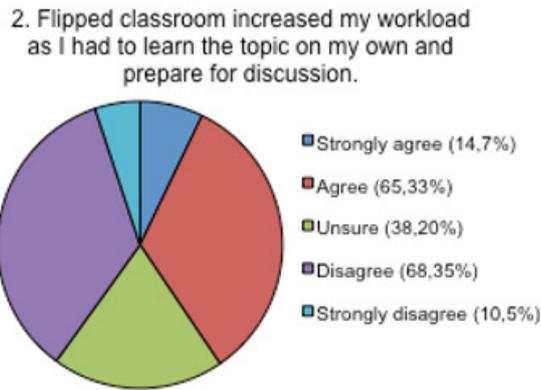


Figure 4. Responses of students to Statement 2 in the survey.

However, opinions were divided with regards to Statement 2 (see Figure 4), on the impact of flipped classroom teaching and learning on students' workload. The total number of students indicating that they "Agree" (65 respondents, or 33%) and "Strongly Agree" (14 respondents, or 7%) with Statement 2 was almost equal to the total number indicating that they "Disagree" (68 respondents, or 35%) and "Strongly Disagree" (10 respondents, or 5%). The remaining 38 respondents (or 20%) indicated that they were "Unsure" of the impact of flipped classroom teaching on their workload. There was no trend observed between the number of videos watched by the students and their responses to this question, i.e., it did not mean that students who watched more videos at home felt that their workload associated with flipped classroom teaching had increased.

### Feedback on the face-to-face session: Statements 4 to 7

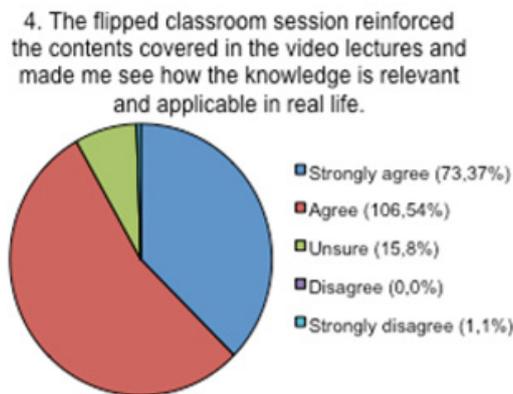


Figure 5. Responses of students to Statement 4 in the survey.

With regards to the face-to-face session, the general consensus amongst the students was that the session not only reinforced the content covered in the video lectures, but also made them see how the knowledge would be relevant and applicable in solving real issues related to practice. This was evident from students' responses to Statement 4 (see Figure 5), with an overwhelming majority of respondents indicating that they "Agree" (106 respondents, or 54%) and "Strongly Agree" (73 respondents, or 37%). Only 1 respondent disagreed, and 15 respondents (or 8%) indicated that they were "Unsure".

5. The flipped classroom session created opportunities for student-student interactions that promoted learning.

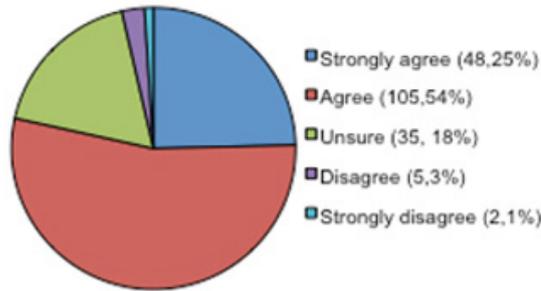


Figure 6. Responses of students to Statement 5 in the survey.

The face-to-face sessions were carried out in classrooms with the chairs and tables arranged for small group discussions. Based on personal observations, this classroom layout facilitated student-student interactions and promoted discussion and learning. These views were similarly echoed by the survey results for Statement 5 (see Figure 6), with the majority of respondents indicating that they “Agree” (105 respondents, or 54%) and “Strongly Agree” (48 respondents, or 25%) that the flipped classroom session created opportunities for student-student interaction that promoted learning. A total of 7 respondents (or 4%) indicated they disagreed (5 respondents, or 3%) and strongly disagreed (2 respondents, or 1%) with Statement 5, and 35 respondents (18%) indicated that they were “Unsure”.

7. I feel less engaged when topics are taught via the flipped classroom method compared to the traditional method of teaching.

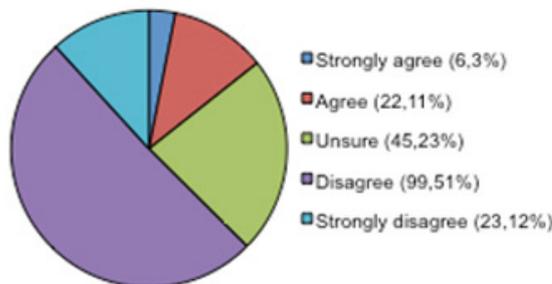


Figure 7. Responses of students to Statement 7 in the survey.

It was also gratifying to note from the survey results that the flipped classroom approach did not result in a compromise in student engagement compared to the traditional didactic lecture. This was based on the results for Statement 7 (see Figure 7), with more than half of the 195 respondents indicating that they “Disagree” (99 respondents, or 51%) and “Strongly Disagree” (23 respondents, or 12%). 45 respondents (or 23%) indicated they were “Unsure”, while the remainder indicated that they agreed (22 respondents, or 11%) and strongly agreed (6 respondents, or 3%) with Statement 7.

6. Flipped classroom teaching has increased my interest in the topic that was taught this way.

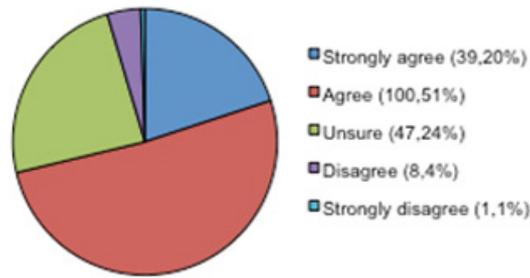


Figure 8. Responses of students to Statement 6 in the survey.

Most importantly, the flipped classroom approach had aroused the interest of the majority of students in the topic that was taught this way, with the majority of respondents indicating they “Agree” (100 respondents, or 51%) and “Strongly Agree” (39 respondents, or 20%) with Statement 6 (see Figure 8). 47 respondents (or 24%) indicated that they were “Unsure”, while the remainder indicated that they disagreed (8 respondents, or 4%) and strongly disagreed (1 respondent, or 1%) with Statement 6.

### **Reflections and overall view on flipped classroom teaching and learning: Statements 8 to 10**

9. Overall, flipped classroom teaching was a positive experience for me and I reaped additional educational benefits compared to the traditional lecture.

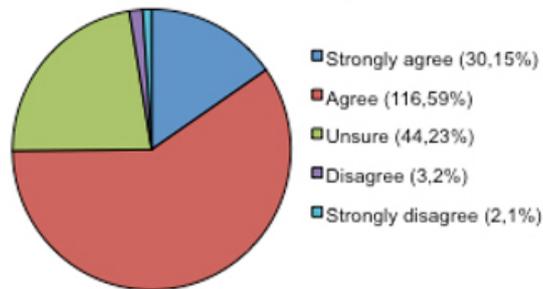


Figure 9. Responses of students to Statement 9 in the survey.

The survey results also showed that the majority of the respondents agreed (116 respondents, or 59%) and strongly agreed (30 respondents, or 15%) with Statement 9 (see Figure 9), acknowledging that the flipped classroom approach was a positive experience for them and that they had reaped additional educational benefits from this teaching method. Only 44 respondents (or 23%) indicated they were “Unsure” and the remainder indicated they disagreed (3 respondents, or 2%) and strongly disagreed (2 respondents, or 1%) with Statement 9.

8. I would like to see the flipped classroom approach in teaching be applied to other (only selected) topics in this module.

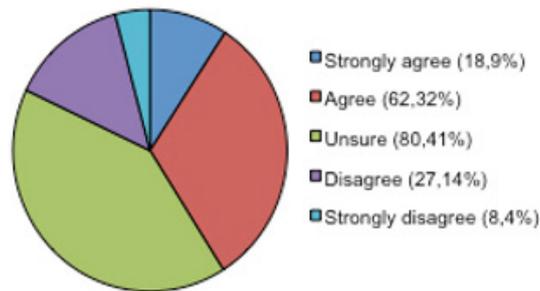


Figure 10. Responses of students to Statement 8 in the survey.

In spite of these advantages, when probed in Statement 8 (see Figure 10) whether the flipped classroom approach should be applied to other selected topics in this module, the survey results once again show that students' opinions were divided. Less than half of the 195 respondents indicated that they agreed (62 respondents, or 32%) and strongly agreed (18 respondents, or 9%) to a wider application of flipped classroom teaching, with a similar proportion (80 respondents, or 41%) indicating that they were "Unsure". The remainder indicated they disagreed (27 respondents, or 14%) and strongly disagreed (8 respondents, or 4%) with Statement 8.

10. Overall, I still prefer the traditional lecture over the flipped classroom method of teaching.

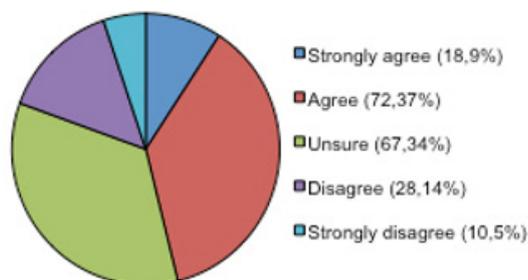


Figure 11. Responses of students to Statement 10 in the survey.

Meanwhile, almost half of the respondents indicated that they agreed (72 respondents, or 37%) and strongly agreed (18 respondents, or 9%) with Statement 10 (see Figure 11). In short, they still preferred the traditional lecture format over the flipped classroom approach. 67 respondents (or 34%) indicated that they were "Unsure", and the remainder indicated that they disagreed (28 respondents, or 14%) and strongly disagreed (10 respondents, or 5%) with Statement 10. It should be highlighted that the students were given 3 months to go through the videos without any formative assessment. The lack of engagement over a relatively long period of time might have contributed to the lukewarm response to this flipped classroom approach.

## CONCLUSION

In conclusion, flipped classroom teaching was successfully carried out in a pharmaceutical formulation and technology module in the Department of Pharmacy at NUS. This approach to teaching and learning was advantageous in that it provided students with the opportunity to apply their knowledge of the design of suppositories in the treatment of malaria.

A survey of student perceptions and attitudes towards the flipped classroom approach revealed that although most students had indicated they experienced the benefits of this approach, a large proportion of them still preferred the traditional lecture method format. As the flipped classroom approach requires students to take greater ownership of their learning, step out of their comfort zones and engage as active learners through discussions with their peers, this may unknowingly create feelings of competition and anxiety. These negative feelings are compounded with the uncertainties of how the flipped classroom approach, if implemented on a larger scale, could potentially impact their academic performance in the module. These are possible reasons why many students still prefer the “tried-and-tested” teaching and learning methods, based on the results of this survey. For the flipped classroom approach to work, it is important to allay the anxiety of the students, to continually engage them and give some incentive for active participation.

Furthermore, as it was neither practical nor feasible to teach the same topic using two different approaches, it may have been difficult for students to compare the effectiveness of traditional lectures and the flipped classroom approach on the same basis. The nature of the topic selected for the flipped classroom approach may skew student perceptions and attitudes towards this new teaching approach. Cross-cohort studies that compare the performances of two different cohorts of students, of which one is exposed to traditional teaching methods and the other to the flipped classroom approach, may provide a possible solution.

Another limitation of this study relates to the time available for peer interaction and discussions. As shown in Table 2, a significant amount of time in each face-to-face session was taken up by the instructor presenting the background of the case study, which left little time for peer discussions and presentations. This could be avoided by having the instructor provide students with the case studies beforehand, so that they can acquaint themselves with the background knowledge necessary for a fruitful discussion. These limitations can be addressed in future extensions of this study.

## ENDNOTE

1. In the survey, the respondents were asked to indicate the number of videos they had watched.

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