Flipped Classroom in a Collectivistic Society: Reactions & Suggestions

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Flipped Classroom in a Collectivistic Society: Reactions & Suggestions

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Flipped Classroom in a Collectivistic Society: Reactions & Suggestions

Abstract

Introduction: Flipped classroom is an educational format that has been proven to provide many benefits. However, the format requires outspokenness and thus may not be congruent with collectivistic cultures. The present study was conducted to gain better understanding of flipped classroom in Thailand, a collectivistic country, using mixed method approach. Qualitative portion of the study employed interpretative phenomenological analysis, while the quantitative portion was conducted in quasi-experimental approach.

Method: Fifth-year medical students and faculty members from Department of Anesthesia, Faculty of Medicine, Khon Kaen University, were recruited to learn and teach using a flipped classroom model in a period covering three clinical rotations, with 13 to 15 students in each rotation. Students were required to prepare themselves with pre-class preparation materials and participate in classroom using interactive and collaborative learning formats.

Data analysis: Qualitative data collection was done through focus-group discussions and individual interviews. Analysis was done using framework method with three analysts. Quantitative data were obtained from institution database.

Results: The process of adoption was quick. Most students were able to adjust to the format within first week of implementation while most faculty members were able to adjust by their second session. Many benefits, such as engaged learning and enjoyment during class time, were mentioned by the students. Faculty members cited the opportunity to better tailor their teaching due to clearer understanding of students' thoughts, and ease of teaching due to students' readiness, as the main benefits. Before exposure, students tended to underestimate their abilities to adjust to the format, a view in which many faculty members shared at the same point in time. However, faculty members were surprised both by the stellar performance by the students and their own lack of readiness for the new format. Potential issues in implementation of flipped classroom were raised by both groups, with suggestions as to how they could be addressed. There were no differences in examination scores between the studied group and the historical comparison.

Summary: Flipped classroom model carries many benefits, and while there are potential obstacles, there are many suggestions on how they can be prepared for in advance.

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Flipped Classroom in a Collectivistic Society: Reactions & Suggestions

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Introduction

The flipped classroom is an innovative concept that allows for an educational environment that is more flexible and more engaging through the use of modern information technologies (Lage, Platt, & Treglia, 2000). The core idea is to provide learners with pre-class self-study materials, collect data from pre-class learning to optimize in-class activities, and finally provide an interactive and collaborative in-class learning experience through engaging formats such as case discussions or group projects (McGowan, Balmer, & Chappell, 2014). This format has been implemented in a variety of disciplines, including health sciences, and has been shown to provide myriad benefits such as better examination scores (Tune, Sturek, & Basile, 2013), more available time for practicum (Long, Logan, & Waugh, 2014), higher learner engagement (McGowan, Balmer, & Chappell, 2014), and easier scheduling of classes (McDonald & Smith, 2013).

Nevertheless, learners and faculty from certain cultural backgrounds may experience difficulty when participating in the flipped classroom model. Mukherjee & Pillai (2013) reported difficulties in implementing the flipped classroom model in a Malaysian university. The authors hypothesized that a high power distance index and strong collectivism could have played an important role in the process. A high power distance index hinders learners' willingness to speak up in the presence of a faculty member or to challenge established concepts such as faculty as the authority; strong collectivism also means that learners may not feel comfortable critiquing their classmates' answers and are more likely to concur with their classmates (Hofstede, 1983). These behaviors inhibit learners from fully engaging in interactive learning experiences like the flipped classroom model. According to Hofstede (1983), similar to Malaysia, Thailand carries a high power distance index and high collectivism; therefore, students and faculty members in Thailand may face similar difficulties in using a flipped classroom model.

As fostering active and independent learning in students is an important goal for Faculty of Medicine, Khon Kaen University, it is important to gain a better understanding of how students and faculty in such setting react to the model and their ideas on how the model can be implemented better. It is also important to measure the model's effects on academic achievements of students to ensure that they are not placed in a disadvantageous situation. There are three research questions in the present study:

- What are the reactions from students and faculty before and after exposure to the flipped classroom model?
- How may a flipped classroom model be conducted successfully?
- What are the effects of a flipped classroom model on the academic achievements of students?

Methods

In order to both gain understanding of the student and faculty's reactions to a flipped classroom, and to also measure the model's effect on academic achievement, a mixed method approach was used in the present study. The first and second research questions were approached qualitatively using interpretative phenomenological analysis and the third question was approached quantitatively using quasi-experimental approach.

The present study was conducted in the Department of Anesthesia, Faculty of Medicine, Khon Kaen University, Thailand. This department oversaw an anesthesia rotation for 5th year medical students, with each rotation lasting three weeks. The present study took place between August and October 2015 and encompassed three rotations (the 4th through 6th rotations of the 2015-2016 academic year). A few factors led to the choice of a setting for this study. First, students from clinical years were chosen because learning to apply is an essential element of the flipped classroom, and the students' proximity to clinical practice should aid in applying knowledge from the model. Second, because we were introducing a new educational format to an uninitiated group, a setting with a relatively small class size was preferable. Third, the Department of Anesthesia was already planning to adopt a flipped classroom as its main educational format, and thus the department was a prime choice for the present study.

Approval was obtained from both Khon Kaen University IRB and Harvard University IRB.

During the study period, classroom activities were changed from traditional lecturing to flipped classroom. Other aspects of the rotation such as journal club, morning academic activities, and practicum in the operating room remained unchanged. As this was a department-wide change, all students had to be enrolled in the flipped classroom model, though they could choose to opt out from having their data collected for research purposes.

All faculty members were invited to participate in teaching using the flipped classroom model but the decision to join the teaching team was entirely voluntary. No reimbursements or other forms of incentives were given to teachers or students in the study. Each faculty member who volunteered had a one-on-one discussion with the principal researcher about how to conduct a flipped classroom before conducting their first class using the model. As the study was ongoing, the principal researcher also observed the faculty members and provided them with feedback aimed toward improving their performance in the model.

Class sizes ranged from 13 to 15 students. Students were broken down into small groups of 4 to 5 members in each. Details of the present study's flipped classroom model can be found in Appendix 1.

Summative examination in the rotation

Every student underwent a summative examination on the last day of their rotation. The examination consisted of three parts: multiple-choice questions (MCQ); essays; and an OSCE. MCQ consisted of sixty 5-choice questions about various topics covered during the rotation in the "Knows" and "Knows How" levels in Miller's Pyramid (Wass, Van der Vleuten, Shatzer & Jones, 2001). The essay consisted of multiple stages of a single clinical scenario in which students were required to make diagnoses and/or formulate treatment plans. The OSCE consisted of three stations of essential skills in anesthesia (intubation, lumbar puncture, and basic ventilator setting). Any student who received lower than 50% of the score in any part would be considered failed and would have to undergo a remediation process.

Quantitative data collection

Student scores from the summative exam and past grades were accessed from a university database by the principal researcher using his faculty member clearance. Data were extracted from the database for the three rotations that took place during the study period, as well as for the students in three preceding rotations to be used as historical comparison. All data were anonymized after extraction by removing student names and ID numbers.

Qualitative data collection

Students were interviewed through a focus-group discussion. All interviews were audio recorded and were conducted by a research assistant in the department using a guide on how to carry out the discussions (Appendix 2). The principal researcher reviewed the recording after each discussion and the two debriefed after each one to ascertain if any adjustments needed to be made.

Each rotation had three focus-group discussions. The first one took place on the first day of the rotation right after the orientation period, before the students had had any exposure to the flipped model. The second one took place on the second week of the rotation after the students finished all flipped sessions; and the third one took place on the last day of the rotation after the students finished the summative examination. Students could choose to opt out from the focus-group discussion at any time.

Faculty members were interviewed using semi-structure in-depth interviews conducted by the principal researcher. Each faculty member was interviewed for the first time before the first rotation, and afterward once after every rotation, for a total of four interviews. Faculty members could decline an interview at any time.

The principal researcher also oriented students in every rotation and gauged their reactions when they were told about the flipped classroom model. He also observed every class to ensure that faculty members followed the model and to record the reactions of both the faculty members and students.

Quantitative data analysis

For the quantitative portion of the study, examination scores and the failure rate of students who were enrolled in the study were compared against historical data. Average scores were compared using an unpaired *t*-test. Failure rates were compared using Fischer's exact test.

Qualitative data analysis

For the qualitative portion of the study, there were three data analysts, including the principal researcher. Data were collected and analyzed in Thai. Translation to English was done after analysis had been completed. Analysis was carried out using the Framework Method (Gale, Heath, Cameron, Rashid & Redwood, 2013). Details of the processes of data analysis can be found in Appendix 3 and strategies used to demonstrate the trustworthiness of qualitative analysis (Shenton, 2004) are described in Appendix 4.

Results

Thirty-seven students were enrolled in the study from three distinct rotations (13, 13 and 11 students, respectively). One student from rotation 1 and another student from rotation 3 declined to participate. All enrolled students participated in all three focus-group discussions except for two students in rotation 1 who opted out of the third focus-group discussion during their rotation.

Of twenty faculty members in the department, seven (two males, five females) volunteered to teach using the new model. Each faculty member was scheduled to be interviewed 4 times. However, one faculty member in this group had a health issue that came up during the study period and thus was interviewed only twice.

Quantitative Data Results
Demographics and test scores from the students enrolled in the study are shown in table 1.

Table 1. Demographics and examination scores of students.

	Historical Comparison (n = 42)	Studied Group (n = 39)	*p*-value
Gender (n, % of male students)	22 (52.4%)	20 (56.4%)	
GPA (range from 0 to 4) (mean, SD)	3.30 (0.44)	3.38 (0.40)	
MCQ score (mean, SD)	49.6 (10.68)	51.1 (10.02)	0.52
Essay score (mean, SD)	52.3 (9.98)	52.6 (9.09)	0.89
OSCE score (mean, SD)	47.6 (9.60)	50.4 (9.66)	0.20
Total score (mean, SD)	149.5 (20.93)	154.0 (21.26)	0.33
Number of failed students (n, %)	4 (9.5%)	1 (2.6%)	0.36

Qualitative Data Results
The qualitative data results consist of two main parts: reactions and suggestions. Reactions are thoughts and ideas that participants had about the flipped classroom, while suggestions are elements that participants believed would improve delivery of a flipped classroom in the setting. This section contains a text summary of qualitative data and the salient themes that emerged from the data. Full tables, including theme names, theme descriptions, and example quotes can be found in Appendix 5.

Reactions from students and faculty members
Reactions from students and faculty members followed a similar overall pattern. There are three major themes that emerged from each group: *Unrealized Concerns*, *Unanticipated Occurrences*, and *Predicted Outcomes*.

Unrealized Concerns are fears or worries that were brought up before exposure to flipped classroom, but that never actually came to fruition during the experience.

Leaners were worried about having to be in a quiet classroom where nobody spoke up and about having to be dependent on groups, which they would have no control over. They also feared being judged by faculty members and being in a classroom where the situation got out of hand and the faculty member

could not handle it well. Fears of some undesirable issues that they had no idea whether or not would come true were salient among students' responses. Example quotes are as follows:

"Students may not be as prepared as they should be, and they may be reluctant to discuss. The class can be silent with only one person speaking"
– Theme: Awkward Silence

"If I don't know what to discuss, maybe the faculty will think that I have not prepared, even though it can be that I still cannot grasp the whole content just yet. The learning atmosphere may go sour."
– Theme: Fear of Judgment

Faculty members were doubtful of the prospect of the flipped classroom, having no idea if it would be successful or not. They were also worried about how much the incongruent local culture would affect student behaviors in the flipped classroom model, whether students would be adequately prepared for class, and whether some students would dominate class discussion. Faculty members did not have much doubt in their own abilities to conduct classroom activities. Rather, their reasons for doubting the success of the model originated from other parties or causes, as illustrated by the following quotes:

"If they don't read before coming to class then everything may fall silent. And what are we going to do then? Do we just wrap up the class? Do we switch back to lecturing?"
– Theme: Doubtful Prospect

"Personally, I am not so sure if this format will fit with our students. It's new, and our students are used to passively receiving knowledge. I'm not sure if they will be able to reach the objectives when we implement it."
– Theme: Cultural Incongruence

Unanticipated Occurrences are upsides, downsides, or observations that the participants had not expected to happen before they were exposed to flipped classroom, but came up during the experience.

Students were happy to discover how capable they were in preparing for a format that they were not familiar with and how enjoyable it was to be able to answer questions and participate. They also realized that there were some adjustments to their schedules and lifestyles that allowed them to better adapt to flipped classroom. Additionally, students experienced one negative surprise that they had not anticipated, that the nature of the flipped classroom would prevent them from covering all details in the subject matter and that they had to cover the details on their own. Example quotes of a positive and a negative theme from this major theme of *Unanticipated Occurrences* are as follows:

"I had to read before coming to class even though I had not been good at preparing. But then I could answer the questions from faculty and that made me feel like an evolved organism"
– Theme: Achievement Unlocked

"I felt like the ten questions could not possibly cover the whole subject matter, and the faculty would only give answers related to the questions. Some points could have been missed."
– Theme: Loss of Details

Faculty members were surprised by many things, both good and bad. They were happy to find out that students prepared themselves much better than expected, that they seemed to really enjoy class time in

the new format, and that the flipped classroom fostered better learning habits in their students. However, there were some negative surprises for the faculty, most of which had to do with their own preparation for the format. They found that the format required more preparation than they had anticipated, that they were not sure which parts of the subject matter would be best covered using mini lectures, that students asked them questions that they were not prepared to answer, and that different student groups could require very different ways of handling. They also found that the new model required a lot of energy from the students and that therefore, a classroom break would have been highly beneficial for the students. Many of the pleasant surprises came from students' stellar performances that exceeded their expectations, while much of the unpleasant surprises came from their own realizations that they were not as ready for the model as they once thought.

"At first I thought they would not be well-prepared and not as ready, they would not be able to answer questions and the class would be silent. But then after having a chance to teach I became like, there was more learning atmosphere than I had once thought."
– Theme: Surprisingly Well-prepared

"I might not know the answer or I might not be able to come up with one fast enough. Some of the questions or ideas from the students – I just had never thought about them before."
– Theme: Unexpected Responses

Predicted Outcomes are the elements that participants expected before the exposure and were found to be true during the experience.

Students expected to be more engaged in the learning process and to to learn through peers. They also expected that the format would require high workload, would foster better learning habits, and that success in the format would largely be dependent on each student's preparation. Being more engaged than they had expected and facing an overwhelming preparation load were two notable themes:

"I felt like I was more involved during class time because I at least had some basic knowledge that allowed me to discuss with my classmates and faculty"
– Theme: Engaged Learning

"I would read beforehand if I had time. I never watched videos. I downloaded the PDFs but I never got to read them because there was so much to go through. I couldn't even finish the books."
– Theme: Higher Workload

Faculty also expected and found higher engagement levels from students. The ability to better tailor their teaching due to a better understanding of student's thinking processes also turned out to be true. Other predictions were that faculty would have to shift roles in the new model, a new skillset would be needed, and that they would not able to exert full control over classroom activities the way they had done in traditional lecturing. Two salient points were that faculty seemed to appreciate being able to understand more about their student's thoughts while simultaneously finding their lack of control in some elements of the class irksome.

"It used to be that we would ask them at the end of a class if they had any questions. They would stay quiet and that was it. We could not tell how much they understood because if they didn't ask questions then we would not be able to know."
– Theme: Focused Teaching

"There were some points that I wanted to introduce but there was not a good time to talk about them"
– Theme: Loss of Control

Suggestions for Improved implementation of flipped classroom

Suggestions for improvement can be divided into multiple areas: *Pre-class Preparation, Faculty Preparation, Classroom Conduct, Curricular Planning* and *Organizational Preparation*. Some of the suggestions came from both students and teachers, while others came from just one group.

Pre-class Preparation includes engaging materials, standard resources, synergistic content, and ease of accessing materials as factors that could be improved. Holding students accountable for studying beforehand was also suggested from the faculty side. The quality and engagement level of preparation materials were mentioned by both groups and can be seen through the example quotes below:

"The videos about physical examination were too long so I skipped them. I would prefer a quick summary." (From student)

"The format [of preparation materials] should be interesting, otherwise [the students] are going to just glance through them." (From faculty)
Theme: Engaging Materials

Faculty Preparation carries themes that were mentioned exclusively by faculty members. They are adequate preparation for faculty members, practicing facilitation skills, getting ready for sessions as the format demands a lot of energy in teaching, and systematic faculty development. In general, themes in faculty preparation capture the overall picture that conducting a flipped classroom may not be as easy as some faculty members had thought, and that many things have to be done correctly for a faculty member to be truly ready for a flipped classroom.

"It actually required more preparation than I had thought."
– Theme: No so Simple

"It took more energy compared to lecturing, because I had to moderate the class, observe students' participation, stimulate them to speak up, all the while thinking about the rest of the lesson that I had to get to."
– Theme: Brace for Impact

Classroom Conduct speaks of a safe and supportive environment as well as welcoming persona from faculty members, which would ensure that students have ample opportunities to open up and voice their opinions without being judged. Other suggestions include elements that are conducive to student learning such as: good time management, classroom content that is complimentary to preparation materials, authentic clinical scenarios, and clear lesson summaries. Atmosphere in the classroom was found to be crucial in both student and faculty views as shown by the following quotes:

"The factor that we talk about is the atmosphere in the room, about our classmates. If it is comfortable to talk and discuss with classmates, then we can share our thoughts more" (From student)

"Try to make them feel that they would be able to think of the answers if they try. When they have a question we can point out where they should begin their thought process, ask them 'if this is the case, then what?' They should be able to continue thinking by themselves." (From faculty)
Theme: Supportive Atmosphere

Curricular Planning includes the following themes: it is important that adequate preparation time is built into the course calendar; that the workload for preparation is leveled out; that all elements in the curriculum are aligned; that topics to be instructed with a flipped classroom model are carefully chosen; and that the difficulty of content matches the student level. Adequate time for classroom preparation came up as a major theme that both groups mentioned, example quotes can be found below:

"I don't think this will be possible when I have a night shift since I will not have time to prepare." (From student)

""There could have been many factors that kept them from preparing for class. They might have to attend patients or they had to write their reports." (From faculty)
Theme: Time for Preparation

Organizational Preparation is key for success of the format. Themes in this category were mentioned exclusively by faculty members. Buy-in from leadership, having support crews for content creation, and reprioritization of incentive schemes are all crucial for making sure that faculty members are incentivized to direct their work in ways that are congruent with the flipped classroom model. Organizational buy-in was raised as vital for success as demonstrated by the following quote:

"I think this format has already been proven to be beneficial, but would the organizational culture adapt to support it? Would the faculty and students adapt to do it?"
*– **Theme: Organizational Buy-in***

Overall Process of Change

Direct observation of the orientation process and all classes revealed that in the beginning, both students and faculty members were worried about the change. The specific details of the worries can be found in Table 1 and Table 3 of Appendix 5. However, adjustment occurred very rapidly and most students had already familiarized themselves with the new format within the first few days. Virtually all faculty members were able to establish overall plans for their classroom conduct by the second rotation. The overall observation was that participants were overly worried about learning/teaching in the model and they did not anticipate that adjustment to the new format would happen as quickly as it did.

Another salient point from the observation was how participants (both students and faculty members) enjoyed classroom time in flipped classroom model. Barring a few classes, the atmosphere in the room was very lively and the level of participation exceeded the expectations of the research team before implementation. Many obstacles were identified in the process but none were seen as insurmountable – they were issues that could be appropriately handled with better understanding of the model.

Overall, the process of changing from traditional lecture to flipped classroom moved from initial skepticism and worry to quick adjustment and, eventually, enjoyment and active participation.

Discussion

The present study describes an implementation of a flipped classroom in a collectivistic society of Thailand. Contrary to the study by Mukherjee & Pillai (2013) in a culturally similar Malaysia, flipped classroom as described in this study was relatively well-received by both students and faculty, and there was no need to revert to traditional lecture. There are many potential explanations for the difference in results of this study and the aforementioned study, though we hypothesize that the class size of the flipped classroom and the decision to break students into small groups in the present study played an important role in the success. Qualitative results in the present study revealed that learning through peers and a supportive atmosphere were highly important to the success of the flipped classroom model. Group work was an essential part of the process as students were split into small groups that had to come up with consensual answers, and they also stayed together for the entirety of the rotation. This might serve as an important factor in encouraging students to overcome fears of speaking up (since they had the support of the group) and reluctance to engage in discussion with one another (since the initial process is confined to a small group). The group setting might have also applied social pressure for students to prepare for class as they were responsible to a group of their peers.

Qualitative results provide directions for future use of the flipped classroom. *Unrealized Concerns* (Appendix 5, Table 1) denotes issues that students and faculty may be worried about when initially introduced to the flipped classroom. The provided results could be used to reassure both groups in future studies or implementation. *Unanticipated Occurrences* (Appendix 5, Table 2) are issues that will likely be overlooked by both students and faculty, and therefore, should be elucidated to them beforehand to ensure adequate preparation. *Predicted Outcomes* (Appendix 5, Table 3 and 4) that are negative are issues that should be managed while those that are positive can be used to reaffirm benefits of the model. The suggestions for improving implementation of this model (Appendix 5, Table 5 to 9) should be consulted before future implementation of the flipped classroom model in a collectivistic society to improve both the quality and delivery of the model.

Examination scores from the students show that students in the flipped classroom model and students in the traditional lecture model did not differ in academic performance. It is important to highlight that despite their unfamiliarity with the model, students in the flipped classroom model could reach similar academic achievements to those in the traditional lecture model. There are many possible explanations for this observation: students might have compensated by studying more, faculty members might have put in more effort in teaching students during practicum, or it might be an indication that the flipped classroom could be adopted without having a significant impact on student performance. Further studies are required to elucidate this point, though it indicates that academic performance using the flipped classroom may not necessarily be inferior to traditional lecture, and thus could be a safe choice for institutions that are interested in utilizing the model.

Limitations of the present study include a non-experimental design, voluntary sampling for qualitative data collection, and the specific characteristics of the utilized flipped classroom. The non-experimental design of this study means that quantitative results cannot be claimed to be conclusive and inference is limited. The voluntary sampling for qualitative data collection raises the possibility that participating

faculty members could have decided to participate because they were already in favor of flipped classroom model over traditional lecture. Finally, the model for a flipped classroom in the present study was a small class of roughly 12 to 14 students split up into small groups of 4 to 5 students each; it may not be possible to fully transfer the results of this study to different classroom sizes/layouts, such as a utilizing the flipped classroom in a large lecture hall setting. These limitations should inform those who may be interested in conducting further research in this direction.

Conclusion

The flipped classroom model resulted in comparable student performance to a traditional lecture model as measured by examination scores. Despite some of the initial concerns of both students and teachers in implementing a flipped classroom model in a collectivistic society, both parties saw the value in the novel teaching technique. Additionally, utilizing the suggestions for improved implementation given by the participants in this study may help to preemptively mitigate any potential issues in future studies. The flipped classroom model should be viewed as a valid instructional format for institutions in a collectivist society that aim to foster active and collaborative learning.

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Appendices

Appendix 1: Details of the flipped classroom model in the present study

Orientation session (first day of rotation);
- Students were instructed about the concepts of flipped classroom model.
- Students were instructed that they had to acquire knowledge before coming to class.
- Students were informed that faculty members would not provide lecture in class.
- Description of classroom activities was given.

Preparation for each class;
- Students were expected to study preparation materials (textbook chapters, articles, videos) via university e-learning website before coming to class.
- Students were separated into groups of 4 to 5 persons. Members of a group stayed together for the entirety of the rotation.
- There were 10 multiple choice questions in each class. Each question was about a clinical scenario that required the students to apply knowledge from preparation materials and make diagnosis and/or provide treatment plans.
- The choices in each question were deliberately designed to serve as conversation starter, even the incorrect ones.

In-class activities;
- Each group worked on the same question, one question at a time.
- Students were given time to discuss within group and reach a consensual answer.
- Answers were revealed only after every group had already committed to an answer.
- Tutor would then ask the groups for their justification of the answers. The tutor might also ask probing questions into the justifications given.
- If answers differed between groups, the tutor would elicit discussion by asking each group to defend its choice against other groups'.
- If every group gave the same answer, the tutor would elicit discussion by asking students to justify their choice against other choices.
- Tutors were expected to steer the discussion toward the correct answer and not to outright provide it, though they could choose to do so if there was a time concern or if they believed that it was not possible for the class to reach the correct answer.
- Tutors could choose to provide class summary but were not required to.

Appendix 2: Guideline for facilitator of focus-group discussion

Guideline for Focus-Group Facilitator

- Avoid opening up with leading questions (Is this good? Will this happen?). Start with the open-ended questions that are listed in the interview guides.

- If you feel that there could be something more from interviewee's response, you can ask focus questions. Leading questions may be necessary in this situation.

- Be careful of your facial expression or non-verbal cues when an interviewee provides a response, though you do not have to force yourself to the point of being unnatural.

- Respect all participants. Be careful to not cut them off. Also try to manage time so every person has enough opportunity to voice their opinions.

Appendix 3: Stages of qualitative data analysis using Framework Method

Stage	Description	Implementation in CT Study
Stage 1: Transcription	Audio recording and verbatim transcription.	Focus group discussions and interview were conducted in person and recorded in digital files. Recordings were transcribed verbatim in Thai language.
Stage 2: Familiarization	Becoming familiar with transcripts and recording initial thoughts in the transcripts.	Three analysts independently read selected transcripts (one rotation out of three for students, two out of seven persons for faculty members) and recorded their thoughts and responses in the transcripts.
Stage 3: Coding	Detailed reading of the transcripts and using labels to describe key elements and phrases found in the transcripts.	The three analysts re-read the transcripts and note the important sentences and paragraphs and provide labels as well as definition for each section.
Stage 4: Develop Working Analytical Framework	After coding all of the selected transcripts, analysts compare codes and agree on a set of codes that will be apply to the rest of the transcripts. Beginning to group codes into category and form framework.	The three analysts met by using video conference to compare their codes and definitions. Any differences were resolved by consensus.
Stage 5: Applying Analytical Framework	Apply codes and categories from Stage Four to the rest of the transcripts. Add new codes and revise existing codes to be consistent with all transcripts.	Principal researcher applied codes to the rest of the transcripts. Elements that did not fit into existing codes/categories and potential revisions of codes/categories were reported to the other two analysts. The decision whether to add new codes/categories or revise existing ones were made by consensus of the three analysts.
Stage 6: Charting Data into Framework Matrix	Use spreadsheet to create a matrix and apply data to the matrix. Reduce data while retaining meaning from each participant.	Categories and codes were put in spreadsheet. Overlapping codes were either combined or refined for clearer differentiation. Definitions were reviewed and revised to ensure clarity.
Stage 7: Interpreting the Data	Writing analytic memos useful throughout to examine in-depth a code, category, or theme of interest and discuss with research team. Describe characteristics and differences between data; relationships among codes and categories. May develop a diagram to depict relationships.	Relationships among codes and categories were established. Major themes and subthemes were developed by grouping related codes or categories together. Comparisons were drawn between data from different time points.

Appendix 4: Strategies to demonstrate trustworthiness

Characteristics that exemplify trustworthiness	Strategies used in this study
Credibility	1) Prolonged engagement through in-depth interviews and focus-group discussions. Data collection at multiple occasions at relevant time points. Samples included both students and faculty members to allow for holistic viewing and comparison. 2) Triangulation was carried out by employing multiple data collection techniques and by comparing results from different groups of subject. 3) Peer debriefing among analysts through multiple video conferences to discuss define, and organize emerging codes, categories, themes and framework.
Transferability	1) Detailed description of the participants, settings, and the implementation of flipped classroom model. 2) Thick description through extensive use of direct quotes from the participant interviews to illustrate the codes, descriptions, themes and framework.
Dependability	1) Detailed descriptions of research design and implementation, as well as the operational details of data gathering.
Confirmability	1) Extensive audit trail for all phases of the study including the project proposal; IRB applications and approval documents; data collection tools; interview transcripts; data bases of codes, categories, definitions; draft frameworks, memos, manuscript drafts. 2) See strategies to ensure credibility.

Appendix 5: Result tables for qualitative data

Students and Faculty Members' Reactions (table 1 to 4)

Themes from students and faculty's responses were placed in the same table for *Unrealized Concerns* (Table 1) and *Unanticipated Occurrences* (Table 2) – there is a label for each theme indicating which group of participants that theme belongs to. Quotes for *Unrealized Concerns* were taken from pre-exposure interviews and focus-group discussions, while quotes for *Unanticipated Occurrences* were taken from post-exposure interviews and focus-group discussions.

For *Predicted Outcomes*, responses are separated into those of students' (Table 3) and those of faculty's (table 4). Quotes from before and after exposure were placed next to each other for easy comparison (see labels in the table).

Students and Faculty Members' Suggestions (table 5 to 9)

Suggestions for improvement can be divided into multiple areas based on their relations to the curriculum, namely *Pre-class Preparation, Faculty Preparation, Classroom Conduct, Curricular Planning and Organizational Preparation*. Some of the suggestions came from both students and teachers, while some others came from just one group.

Each area of suggestions is elaborated using a distinct table with quotes from both students and faculty. Some themes may be shared by both groups while some other themes may be exclusive to either group. The five areas are described in table 5 -9, respectively.

Appendix 5: Result tables for qualitative data (continued)

Table 1. Unrealized Concerns (Students and Faculty)

Unrealized Concerns	Theme	Example Quote
Unrealized Concerns *Fears, worries or concerns about flipped classroom that had been raised before exposure to the model but did not come true during the experience.*	**Awkward Silence** Students find the idea of a quiet classroom where nobody speaks up repulsive. *(Student)*	"Students may not be as prepared as they should be, and they may be reluctant to discuss. The class can be silent with only one person speaking"
	Loss of Control Classroom situation may get out of control. *(Student)*	"So, would the faculty be able to control the content at all time? When anybody can speak up, I don't know if they will be able to handle the actual class."
	Fear of Judgment Students fear they could be judged by the faculty. *(Student)*	"If I don't know what to discuss, maybe the faculty will think that I have not prepared, even though it can be that I still cannot grasp the whole content just yet. The learning atmosphere may go sour."
	Dependence on Group Success in the format depends on the groups; which students cannot control. *(Student)*	"It is going to depend on the group. It is up to each group if they can reach the important points in their discussion. If they cannot, the quality will surely go down."
	Doubtful Prospect Faculty are unsure if the model will be successful. *(Faculty)*	"If they don't read before coming to class then everything may fall silent. And what are we going to do then? Do we just wrap up the class? Do we switch back to lecturing?"
	Cultural Incongruence Flipped classroom is not congruent with local culture and that may affect how successful the model is. *(Faculty)*	"Personally, I am not so sure if this format will fit with our students. It's new, and our students are used to passively receiving knowledge. I'm not sure if they will be able to reach the objectives when we implement it."
	Failure to Prepare Students may not understand their responsibilities and fail to prepare themselves for the format. *(Faculty)*	"My only concern is that Thai students may not be familiar with preparing themselves before coming to class, so we have to make sure they understand the new format, that they will have to learn the content before coming to class."
	Dominating Personality Some students may dominate the class. *(Faculty)*	"Each student will be different in how outspoken they are. Some of them might dominate the class and suppress others from voicing their opinions."

Table 2. Unanticipated Occurrences (Students and Faculty)

Unanticipated Occurrences	Theme	Example Quote
Phenomena, problems, behaviors and other issues that had not been expected prior to the exposure but were found to be present during the experience.	**Achievement Unlocked** Some students found out that they were better than they had thought. **(Student)**	"I had to read before coming to class even though I had not been good at preparing. But then I could answer the questions from faculty and that made me feel like an evolved organism"
	Loss of Details The nature of the format means that it was not possible to cover every detail. **(Student)**	"I felt like the ten questions could not possibly cover the whole subject matter, and the faculty would only give answers related to the questions. Some points could have been missed."
	Survival Tactics Some students found ways to adjust preparation process to fit with their life situations. **(Student)**	"Around the end I would read before class, but not to the point where I understood everything, just enough for me to recognize them. I might or might not do the quizzes, then I tried to get the rest during class time."
	Unexpectedly Hard Faculty found out that they had underestimated the preparation that they needed. **(Faculty)**	"It actually required more preparation than I had thought."
	Unexpected Responses Sometimes students came up with answers or questions that faculty had not thought of and they might struggle to respond. **(Faculty)**	"I might not know the answer or I might not be able to come up with one fast enough. Some of the questions or ideas from the students – I just had never thought about them before."
	Surprisingly Well-prepared In general, students prepared themselves much better than the faculty had anticipated. **(Faculty)**	"At first I thought they would not be well-prepared and not as ready, they would not be able to answer questions and the class would be silent. But then after having a chance to teach I became like, there was more learning atmosphere than I had once thought."
	Students' Enjoyment Many students seemed to enjoy class time in the new format. **(Faculty)**	"They seemed happy when they got to voice their opinions and share ideas. It seemed better than the old way where many students were sulking and confused."
	Better Habit The new format helped students develop better learning habit. **(Faculty)**	"One good thing is that it makes students responsible for preparing themselves for class. I think it will be very useful if the students can learn to read before coming to class."
	In-class Fatigue Because students had to be highly active, they got exhausted when a class went long. **(Faculty)**	"They seemed happy but one problem was that they were tired. Say we had ten scenarios, they would stay fresh for about four or five of them, then they would get tired and either could not comprehend questions or miss the objectives."
	Group Idiosyncrasy Different groups of students had different characteristics and had to be handled differently. **(Faculty)**	"The classroom atmosphere could be different for each group of students. Students in last group were not responding as well as those in the one before them."
	Mini Lectures Faculty had to be selective if some parts of the lesson should be delivered in a mini lecture. **(Faculty)**	"Some parts should be given to them. Extra teaching should be done for the points that they students cannot learn by themselves."

Table 3. Predicted Outcomes (Students only)

Predicted Outcomes *Phenomena, problems, behaviors and other issues that had been expected to be true about flipped classroom and remained true after exposure.*	Theme	Pre-exposure Quote	Post-exposure Quote
	Engaged Learning Students anticipate being more engaged in their learning.	"Because the format requires us to prepare by ourselves and discuss, so students should have more participation in the classroom. Those who are normally quiet should get more opportunities to share their ideas."	"I felt like I was more involved during class time because I at least had some basic knowledge that allowed me to discuss with my classmates and faculty"
	Peer Learning Learning can happen through peers.	"So we will get to learn by ourselves and hear our classmates' ideas if they are similar to ours or not."	"Working in a small group meant that everyone of us had opportunities to share our ideas. Then we could see if we were right and if our ideas lined up with others', why and why not? Then we got to discuss about them."
	Higher Workload There will be more workload compared to traditional lecture	"The pressure will be on students like us to prepare ourselves better."	"I would read beforehand if I had time. I never watched videos. I downloaded the PDFs but I never got to read them because there was so much to go through. I couldn't even finish the books."
	Learner Dependent Quality of learning is dependent on each student	"Actually, if we will talk about quality of learning then it is going to depend mainly on each student if they come prepare or not."	"If I came to a class unprepared then I would not understand anything from beginning to the end."
	Better Habit The format will help in fostering better learning habit.	"It should stimulate us to be more active in studying the materials."	"I guess the avid students must have studied consistently whether it was at the beginning of the rotation or the end. But those who normally procrastinated until the end of blocked had been forced to study because they feared they would not be able to discuss in class."

Table 4. Predicted Outcomes (Faculty only)

Predicted Outcomes *Phenomena, problems, behaviors and other issues that had been expected to be true about flipped classroom and remained true after exposure.*	Theme	Pre-exposure Quote	Post-exposure Quote
	Higher Engagement Students are expected to be more engaged in this format.	"Students should be more engaged compared to the old model where they only sit and listen. They should feel that it's now their responsibilities to solve the scenarios and will be more alert than before."	"I felt good after I finished my class, for one thing it made learning fun. Students would wonder what the cases were about and they would think along. They must have enjoyed it more than being fed."
	Focused Teaching Faculty will be able to detect misconceptions and focus on them.	"[In traditional lecture format] we could not tell if students understood or not. Because if they did not speak out, we would not be able to tell if they had it right or wrong."	"It used to be that we would ask them at the end of a class if they had any questions. They would stay quiet and that was it. We could not tell how much they understood because if they didn't ask questions then we would not be able to know."
	Shifting Roles The roles of the faculty will have to change in the new format.	"The new format means they will have to discuss and try to reach the answers themselves while we observe and try to guide them. That's my idea of it."	"While they were working on the case I would have to think about the issues that they should discuss, what questions I should ask and then follow up on them. I would have to think about how to respond to them."
	New Skillset Faculty need a different skillset from the ones that they used to have.	"Faculty in this format need higher skills than those doing lecture because in lectures, everything is controlled by the faculty."	"I had to try and attempted to draw several scenarios together for the students to see the big picture of how they should handle those cases."
	Loss of Control Faculty can exert less control over how class time unfolds.	"There is one very important limitation to this format – because we cannot control what the students do. And students who have not been familiar with it may not care to change their learning behaviors to those that will give them more work."	"There were some points that I wanted to introduce but there was not a good time to talk about them"

Table 5. Suggestions for pre-class preparation (Students and faculty)

Pre-class Preparation *Suggestions regarding preparation materials or the process of preparation for class on the students' part.*	Theme	Quote from students	Quote from faculty
	Engaging Materials Preparation materials should be concise, novel, and engaging.	"The videos about physical examination were too long so I skipped them. I would prefer a quick summary."	"The format [of preparation materials] should be interesting, otherwise they are going to just glance through them."
	Standard Resource Students should be provided with referenced materials and not required to search for materials by themselves.	"If the curriculum requires us to prepare and solve problems by ourselves then there should be sources that are accepted standard."	"We should focus on standard references and they should not be required to read anything outside those, because other things may not be so clear or outright wrong."
	Synergy in Content Different parts of materials should be complimentary to each other.	"So if the faculty thinks that some particular points are difficult, then they should add a video so I can watch the video after I finish reading. That way I can better understand what I have been thinking about."	N/A
	Ease of Accessing Preparation materials should be easily accessible.	N/A	"If they have no idea as to how they can find the required resources then they might give up trying. We should provide the right resources for them to prepare."
	Required Preparation There should be some forms of obligations or incentives for students to prepare themselves before coming to class.	N/A	"We should require them to prepare. If they don't prepare then there should be some punishment or something else. They currently have no incentives to read, there are no marks to the process, why would they prepare before coming to class?"

Table 6. Suggestions for faculty preparation (Faculty only)

Faculty Preparation *Suggestions regarding how faculty members should do to be ready in conducting flipped classroom.*	Theme	Quote from students	Quote from faculty
	Not so Simple Preparation for faculty will be harder than many anticipate.	N/A	"It actually required more preparation than I had thought."
	I, Facilitator Faculty should be well prepared in facilitation skills.	N/A	"My take is that faculty are to stimulate students to share their ideas and carry out the activities, then they should observe if things go according to plan or not."
	Brace for Impact Conducting flipped classroom can be highly energy-consuming and faculty should be ready for it.	N/A	"It took more energy compared to lecturing, because I had to moderate the class, observe students' participation, stimulate them to speak up, all the while thinking about the rest of the lesson that I had to get to."
	Faculty Development Faculty will need to undergo faculty development specific to the model.	N/A	"We may need to coach new faculty in the beginning until they are ready to carry on by themselves."

Table 7. Suggestions for classroom conducts (Students and faculty)

Classroom Conduct	Theme	Quote from students	Quote from faculty
Classroom Conduct *Suggestions regarding how activities in the classroom should be handled, as well as how to manage the atmosphere and environments in the classroom.*	**Supportive Atmosphere** Supports from both faculty and peers is vital for learning in this format.	"The factor that we talk about is the atmosphere in the room, about our classmates. If it is comfortable to talk and discuss with classmates, then we can share our thoughts more"	"Try to make them feel that they would be able to think of the answers if they try. When they have a question we can point out where they should begin their thought process, ask them 'if this is the case, then what?' They should be able to continue thinking by themselves."
	Welcoming Persona Friendliness of faculty can encourage students to learn more.	"Faculty that will enhance learning are those that seem friendly and approachable."	"Faculty should appear friendly, and they should be open. They have to make students feel that anything can be shared, that they are not being judged to be right or wrong and they won't suffer any consequences."
	Time Management Skills to manage time is vital to pace classes properly.	"I felt like the discussion took a little bit too long. That made it somewhat tedious and boring"	"One downside is that we cannot control time at every step, so we have to always be conscious of it and be ready to manage it."
	Learning by Application Authentic clinical scenarios that allow students to apply knowledge greatly enhance learning.	"I think it's good to learn about clinical scenarios where we have to anticipate complications or formulate treatment plans; like short cases or long cases; since we get to discuss with each other."	N/A
	Top-up Content Some extra content that compliments the questions should be provided.	"Good faculty in my opinion are those who add something extra from what is in the questions. That will make me focus since that's new knowledge."	N/A
	Review of Content Lesson summary or take home messages should be provided.	"Every time we finish discussing something, I would love for the faculty to summarize the concepts and key points. Sometimes I felt lost after class because I was not sure if I understood things correctly."	N/A
	Opportunities for Discussion Providing enough opportunities for discussion is vital.	N/A	"One thing that should not be done is restricting the students' opportunities to discuss and interact. Faculty should not speak too much."
	Gauge the Gap Faculty will have to distance themselves correctly.	N/A	"I'm not sure if it was the right thing when I got too close to them or tried too hard to stimulate them. I don't know if they felt intimidated."

Table 8. Suggestions for curricular planning (Students and faculty)

Curricular Planning	Theme	Quote from students	Quote from faculty
Curricular Planning *Suggestions regarding other elements in the course or curriculum that are outside of classroom context but can have significant impact on success of the model.*	**Time for Preparation** Time is of vital importance to prepare well.	"I don't think this will be possible when I have a nightshift since I will not have time to prepare."	"There could have been many factors that kept them from preparing for class. They might have to attend patients or they had to write their reports."
	Aligned Curriculum Each element in the curriculum should be in line with the change in instructional format.	"Considering that we have been learning about large, important points; the summative examination should not ask about specific tiny details because that's not what we have been studying for."	"It's very important that the examination matches with the learning format, otherwise it will be a huge problem for the students."
	Topic Selection Flipped classroom may fit better with some topics than others.	"Most of the time reading by myself before answering the quizzes was okay. But there were some parts that required a lot of calculations, and even though I had already studied beforehand, it could still be confusing."	"If we use this format in the topics that are compatible then it should be better than lecturing."
	Leveled Workload Classes and their preparation materials should be spread out so that each day requires similar workload.	"Some topics differed so much in the amount of content. Some of them were only ten pages long while some others had forty pages. In summary, some days were easy to prepare for while some other days could be very hard"	N/A
	Fitting Difficulty The difficulty level of the lessons should be appropriate for the level of the students.	N/A	"The questions that we give them should be those that they can reach the answers without too much difficulty."

Table 9. Suggestions for organizational preparation (Faculty only)

Organization Preparation *Suggestions regarding changes in the organizational level that can affect how flipped classroom is carried out.*	Theme	Quote from students	Quote from faculty
	Organizational Buy-in Cooperation from other groups in the organization is vital for long-term success.	N/A	"I think this format has already been proven to be beneficial, but would the organizational culture adapt to support it? Would the faculty and students adapt to do it?"
	Team Effort Support crews for content creation and other types of work will be very important.	N/A	"Support crew is very important, especially when it comes to media creation."
	Reprioritzation Priorities in faculty' performance evaluation may have to be shifted around to support the new format.	N/A	"We should have time to develop resources for instruction, but then our department only consider class time for workload evaluation, while resource development is not considered a part of teaching."