

ปรากฏการณ์วิทยาต่อประสบการณ์ของอาจารย์เทคนิคการแพทย์ ในห้องเรียนกลับด้านโดยใช้บทเรียนออนไลน์แบบ Small Private Online Course (SPOC)

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บทคัดย่อ

ปัจจุบันการจัดการศึกษาระดับอุดมศึกษานิยมใช้ห้องเรียนกลับด้านโดยใช้บทเรียนออนไลน์แบบ small private online course (SPOC) อย่างแพร่หลาย แม้ว่านักเรียนจะชื่นชอบรูปแบบของการเรียนการสอนแบบปฏิรูปนี้แต่ข้อมูลเกี่ยวกับการรับรู้ของอาจารย์ในการเรียนการสอนรูปแบบใหม่นี้ยังมีจำกัด การศึกษานี้จึงมีวัตถุประสงค์เพื่อสำรวจประสบการณ์ของอาจารย์เทคนิคการแพทย์เมื่อนำห้องเรียนกลับด้านโดยใช้บทเรียนออนไลน์แบบ SPOC มาใช้ในการเรียนการสอนหัวข้อ “การตรวจจบบัญชีทางภูมิคุ้มกันและการประยุกต์ใช้” ของรายวิชาภูมิคุ้มกันวิทยาพื้นฐาน สำหรับนักศึกษาเทคนิคการแพทย์ระดับปริญญาตรี คณะเทคนิคการแพทย์ มหาวิทยาลัยมหิดล ด้วยวิธีการทางปรากฏการณ์วิทยา โดยอาจารย์เทคนิคการแพทย์ที่สอนในรายวิชาภูมิคุ้มกันวิทยาพื้นฐาน จำนวน 10 คน ตอบรับเข้าร่วมในการสัมภาษณ์เชิงลึกเป็นรายบุคคล นำบทสัมภาษณ์อาจารย์มาวิเคราะห์โดยผู้ตรวจสอบที่เป็นอิสระต่อกันโดยใช้แนวทางการวิเคราะห์ข้อมูลเชิงคุณภาพด้วยเทคนิคการวิเคราะห์แก่นสาร (thematic analysis) ซึ่งสามารถรายงานปัจจัยหลัก 6 ประการที่เกี่ยวข้องกับประสบการณ์ของอาจารย์เทคนิคการแพทย์ในกระบวนการปฏิรูปการสอนนี้ ได้แก่ 1) แรงจูงใจของการสอน 2) การทำกิจกรรมในชั้นเรียน 3) การประเมินการเรียนรู้แบบรายทางของนักศึกษา 4) การประเมินการเรียนรู้แบบปลายทางของนักศึกษา 5) ผลการเรียนรู้ และ 6) ความยากของการดำเนินการสอน การจัดหมวดหมู่ประสบการณ์ของอาจารย์เทคนิคการแพทย์ที่ชัดเจนนี้อาจช่วยดึงดูดความสนใจในการนำห้องเรียนกลับด้านโดยใช้บทเรียนออนไลน์แบบ SPOC มาประยุกต์ใช้เพิ่มขึ้น และกระตุ้นการสนับสนุนของสถาบันเพื่อปรับปรุงการเรียนการสอนในเทคนิคการแพทย์ศาสตร์ศึกษา

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โดยใช้บทเรียนออนไลน์แบบ SPOC

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Phenomenological Approach on Experiences of Medical Technology Teachers in Small Private Online Course (SPOC)-based Flipped Classroom

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Abstract

Small private online course (SPOC)-based flipped classroom mode has been widely used in higher education. Although students appreciated the reformed teaching curriculum, the information on teachers' perceptions is limited. This study aimed to explore the experiences of Medical Technology (MT) teachers when SPOC-based flipped classroom was first implemented in the topic of detection of immunological reactions and applications in basic immunology course for undergraduate students. Through a phenomenological approach, ten immunological teachers agreed to participate in individual in-depth interviews. The transcriptions of the interviews, as qualitative data, were analyzed by independent reviewers using a thematic analysis approach. Six main factors related to the experiences of MT teachers in the process of reformed teaching were reported, including 1) Motivation, 2) In-class activities, 3) Formative assessment, 4) Summative assessment, 5) Learning outcomes, and 6) Difficulty of teaching. These elucidating categories might draw more attention to further SPOC-based flipped classroom applications and stimulate institutional support to improve teaching and learning in Medical Technology education.

Keywords: Medical technology education, Teacher perception, Blended learning, SPOC-based flipped classroom

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Introduction

Traditional classrooms in healthcare education have progressively shifted towards a blended learning model.⁽¹⁻²⁾ The most famous type is flipped classroom, in which pre-class learning materials such as videos, e-learning, and lecture notes are provided for self-learning. Students must complete their knowledge before connecting to face-to-face classes for more active learning strategies using reflection, problem-based discussion, or case-solving.⁽³⁻⁴⁾ Medical students had high satisfaction and gained an increase in academic achievement when flipped classrooms were implemented in the studies of gynaecologic oncology, ophthalmology, endocrinology, radiology, and physiology.^(1,2,5-7) Most students strongly agreed that this learning method leads to pleasure in learning and flexibility to motivate their education, enhance communication skills, and improve clinical thinking compared to conventional classroom teaching.⁽⁶⁻⁸⁾ Additionally, some students perceived that the flipped classroom approach could enhance their lifelong self-directed learning skills compared to traditional lectures.⁽⁹⁾

Since a small private online course (SPOC) is well-established as an online educational platform, the SPOC teaching mode is designed in a particular scope for a specific audience and therefore has a greater capacity to adapt to the interested needs.⁽¹⁰⁻¹¹⁾ Normally, students access online videos or learning

materials within the SPOCs under the guidance of teachers and then participate in classroom discussions and problem-solving activities. This specific characteristic allows SPOC to be a widely accessible tool for autonomous learning, which can reduce students' high drop-off rate within the first week of the course.⁽¹²⁾ In medical education, SPOC is commonly used to support the blended learning model of the flipped classroom. Medical students access online videos and reading materials in the SPOC and contribute effectively to in-class activities.^(10,13) Post-graduate medical educators largely give positive feedback when using SPOC video technology and web conferencing software for integrated case conferences and in-depth neuroscience discussions across diverse locations in psychiatry training programs.⁽¹⁴⁾ Additionally, the SPOC-based flipped classroom mode implemented in the physiology course demonstrated learning efficiency and fostered a deep understanding of knowledge for clinical undergraduate students. This was reflected in higher examination scores compared to students engaged in lecture-based learning. The significant difference in their scores can be attributed to the SPOC model's video-based preview.⁽¹⁵⁾ Notably, the powerful application of SPOC-based flipped classrooms was seen in such enhancements of learning outcomes among undergraduate medical students in oral histopathology learning during the COVID-19 pandemic. Both students and

teachers expressed a positive reception towards this reform class and perceived it as improving self-directed learning while fostering an active atmosphere with deep participation.⁽¹⁶⁾

In medical technology education, technology-enhanced education has been recently reported. Medical technology students who participated in blended medical laboratory courses could improve their self-learning capacity and understanding of the underlying theories and problem-solving rather than traditional classroom teaching. The achievement of their knowledge goals was significantly seen in the average scores on laboratory quizzes.⁽¹⁷⁾ The flipped classroom strategy also encouraged the learning capacity of medical technology students and provided positive interaction for students to have high-order thinking in evidence-based medicine training compared to traditional classrooms.⁽¹⁸⁾ Furthermore, SPOC-based flipped classroom modules showed good effectiveness in clinical hematology laboratory teaching, as they enhanced medical technology students' confidence in their professional theories and practical skills. Most medical technology students showed positive attitudes and views on the reform class.⁽¹⁹⁾ SPOC based flipped classroom method also improved students' knowledge of immunology reactions and applications by significantly increasing the overall scores on both the mid- and post-conceptual tests among undergraduate medical technology students. The results revealed that

a greater interest and enjoyment, coupled with reduced anxiety in this reform course, could encourage students to connect the topic with their future careers.⁽²⁰⁾

Although medical students have a strongly positive perception of the SPOC-based flipped classroom pedagogy^(15,21), investigating teachers' perception and understanding of this reform teaching process is also important. Evidence shows that the role of teachers must be transformed into that of facilitators, mentors and designers of students' learning, which is always a challenge for educators.^(8,22) Most teachers recognize that reform teaching has the potential to contribute to classroom interactions, leading to more active learning, higher order thinking, and improved student performance.⁽²³⁻²⁴⁾ This phenomenon is further supported by teachers' perspective on their effective position in educational reform teaching, which has a positive impact on students' learning objectives.⁽²⁵⁾ The consolidated view from teachers is to utilize classroom time effectively for problem-solving activities, discussions, and engaging lesson delivery.⁽²⁶⁾ Collectively, teachers' experience indicates that modern practices such as teamwork and class discussions are strongly associated with better students' learning achievements, as compared to a traditional practices like rote learning and individual work.⁽²³⁻²⁶⁾ Even though teachers have a positive attitude towards the flipped classroom, they still express concerns about

their competency in designing flipped learning, difficulties in pre-class and in-class activities, and technology-supported education.⁽²⁷⁻²⁸⁾ Therefore, it is important to conduct in-depth interviews to investigate the exact factors influencing teachers' experiences and perceptions during reform teaching.

Due to the benefits of SPOC, it is widely combined with flipped classrooms. As a result, there has been a growing interest in the application of SPOC-based flipped classrooms in Thailand. Unfortunately, there is no information focused on the experience and perspective of medical technology teachers in SPOC-based flipped classroom pedagogy practice. To understand the lived experiences of teachers in the potential of this particular reform setting, a phenomenological approach as one of the qualitative research methods is often used based on in-depth interviews.⁽²⁹⁻³⁰⁾ Hence, this study aimed to explore the experiences of medical technology teachers in adapting SPOC-based flipped classroom modules in immunology studies through a phenomenological approach. The results of this study can provide valuable information for medical technology teachers interested in designing reform pedagogy.

Materials and Methods

1. Study design

Descriptive phenomenological research was conducted in this study to understand the

experiences and perspectives of medical technology teachers who were the first to participate in the SPOC-based flipped classroom teaching method on the topic of immunological reactions and applications in a basic immunology course at the Faculty of Medical Technology, Mahidol University in Thailand. A semi-structured interview guide, predominantly consisting of open-ended questions, was created and utilized to conduct interviews with medical technology teachers. The interviews aimed to investigate the benefits and obstacles associated with this pedagogical approach.

2. Participants and settings

The instructional design of the SPOC-based flipped classroom was developed from May to June 2020. It involved self-directed learning on the SPOC platform and face-to-face teaching activities in the classroom (Fig. 1). The SPOC platform was created within the online university settings, accessible via <https://mux.mahidol.ac.th/courses/course-v1:MU-MT+MTMI307+2019/course/>. To organize the pre-class tasks, medical technology students enrolled in the SPOC course using their individual MU login and were required to complete a pre-test. Students could structure their learning process in the SPOC course by watching infographic videos, reading teaching documents, and completing post-tests related to the learning content in each topic. During

SPOC learning, teachers would release the teaching plan one week in advance to communicate the learning objectives and facilitate effective self-learning. In classroom teaching time, all students were randomly divided into groups and engaged in face-to-face laboratory activities with teachers (student-to-teacher ratio = 10:1 in each group). Each group was assigned a question for discussion. The teachers acted as organizers and facilitators of learning, guiding students to find answers to problems on their own and inspiring their enthusiasm for information. The post-test in SPOC course and the in-class observation by teachers served as representative formative assessments. The extension of students' abilities after the SPOC-based flipped classroom module was evaluated using the course examination, which represented

a summative assessment. After the reformed teaching was completed, ten medical technology teachers responsible for the basic immunology courses were invited to participate in an in-depth interview. All participants had no previous training experience and practice in the SPOC-based flipped classroom method, and their individual characteristics are shown in Table 1. The participants were informed about the purpose of the interview, and measures were taken to ensure their anonymity and confidentiality. Subsequently, each participant signed the informed consent form and willingly participated in collecting data without compensation. The study was approved by the Central Institutional Review Board Ethics Committee of Mahidol University (MU-CIRB 2019/158.0710).

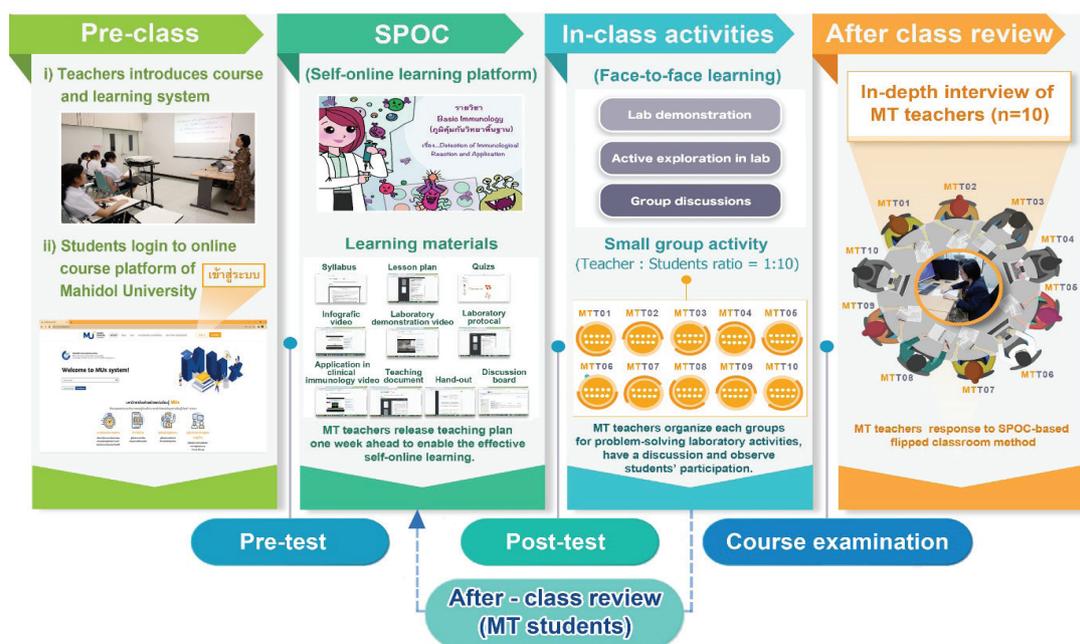


Fig. 1 Instructional design of SPOC-based flipped classroom.

Table 1 Characteristics of participants.

Participants	Sex	Age (Year)	Position	Educational Background	Teaching Experience (Year)
A	F	48	Assistant professor	Medicine	16
B	F	35	Lecturer	Biomedical Science	5
C	M	40	Associate professor	Medical Technology	11
D	F	40	Associate professor	Medical Technology	10
E	M	39	Lecturer	Biomedical Science	3
F	F	30	Lecturer	Immunology	1
G	F	44	Assistant professor	Medical Technology	22
H	F	38	Lecturer	Health Biology	2
I	M	33	Lecturer	Medical Technology	1
J	F	34	Lecturer	Immunology	2

M; Male, F; Female

3. Data collection and analysis

Qualitative data were collected through a semi-structured interview guide with a preponderance of open-ended questions. The designed questions were guided by Park *et al.*⁽²⁷⁾, as provided in Table 2. During the interviews, individual participants shared their experiences and perceptions regarding the implementation of the SPOC-based flipped classroom. Each interview lasted approximately 60 minutes. All interviews were transcribed and assigned a sequential number. When additional data were needed, it was collected by phone. For data analysis, the transcribed interviews were analyzed using a thematic

analysis approach.⁽³¹⁾ Firstly, the authors (SL and KK) individually read the data several times to better understand it and generated their own initial codes. Next, the authors searched for patterns and themes emerging from the codes and data. The codes were compared together, and any code that did not match was eliminated. Then, the themes were independently reviewed by each author (SL, KK, and PP) to reach investigator triangulation. The authors engaged in discussions to define and label the themes, aiming to reach a consensus agreement. Finally, all data and initial themes were revisited to ensure that they provided an authentic experience of the current teaching.

Table 2 Example of medical technology teachers interview questions.

1) What were motivations for SPOC based flipped classroom?
2) What did you learn from SPOC based flipped classroom including prerequisite learning, class activities, and formative and summative assessment?
3) Please explain what you experienced with SPOC based flipped classroom?
4) Please explain what were the difficulties in SPOC based flipped classroom?

Results

After completing the interviews and thematic analysis, six overarching themes of the participants' experiences in SPOC-based flipped classroom emerged: Motivation,

In-class activities, Formative assessment, Summative assessment, Learning outcomes, and Difficulties of teaching. The categories and codes in each theme are elaborated in Fig. 2.

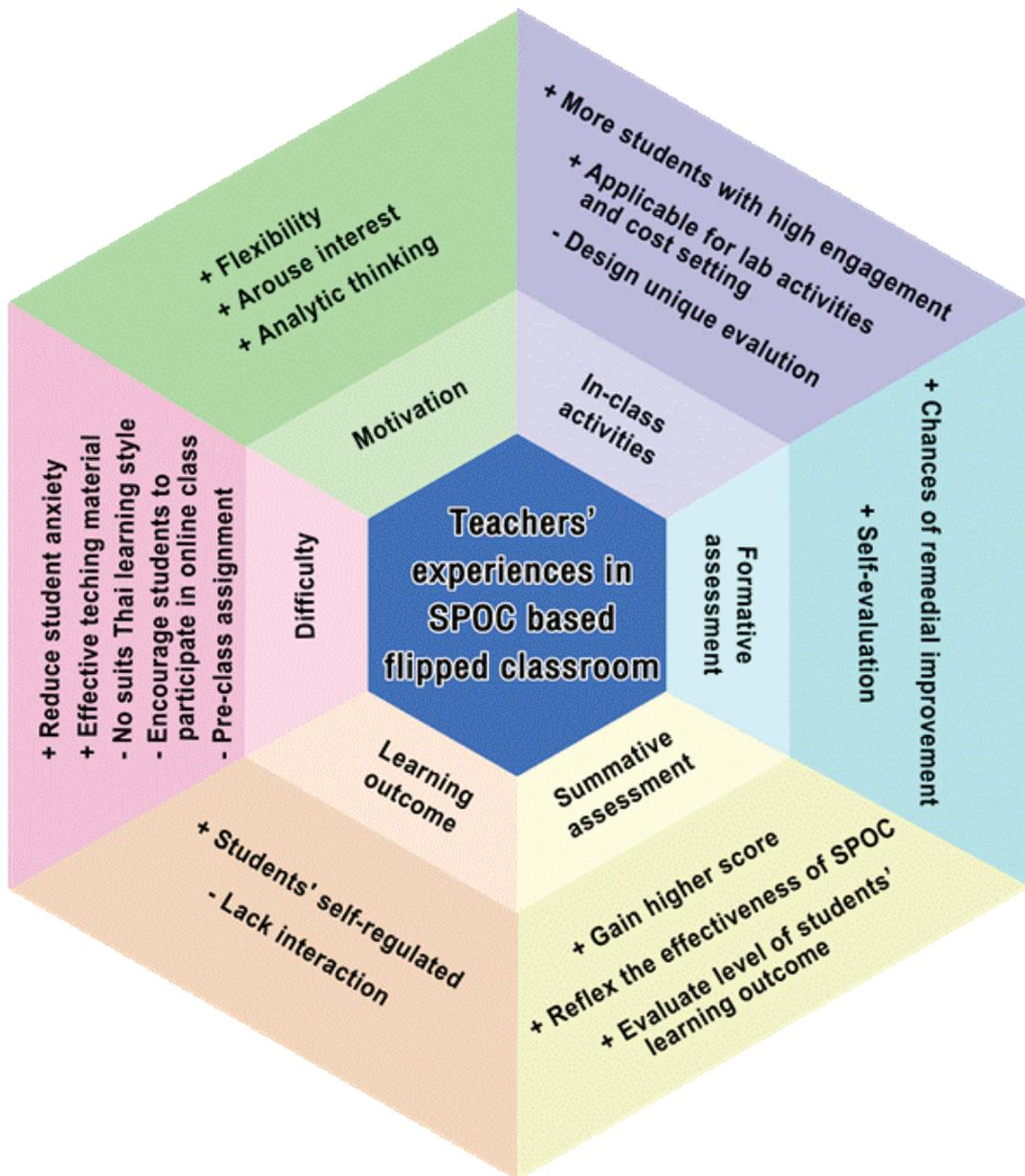


Fig. 2 Categories and themes of medical technology teachers' experiences in SPOC-based flipped classroom.

Motivation to use the SPOC based flipped classroom approach for supporting students' learning

All participants perceived that the SPOC-based flipped classroom approach created an effective learning environment for understanding and applying immunological reactions in a basic immunology course. This approach allowed students to organize their learning pace flexibly, anytime and anywhere, using the SPOC platform. Additionally, the well-prepared content on the SPOC, particularly the online videos, enhanced students' learning abilities and performance. After their self-active learning and having the fundamental knowledge, students could develop their analytical thinking skills and enjoy the in-class laboratory session. One of the interviewed Medical Technology Teachers (MTT) stated:

“Our intention was to design the SPOC online lessons following the “simple and practical” principle. This approach allowed our MT students to attentively acquire knowledge step-by-step, starting from the basic principles and progressing to test procedures, results, interpretations, and clinical applications in immunology. They had no restrictions to access the SPOC lesson until they reached their understanding” (MTT 06).

Another MTT stated that *“the SPOC-based flipped classroom helped my students learn by themselves; students were more*

enthusiastic and gained better analytical thinking processes” (MTT 04).

In-class activities after implementing the SPOC-based flipped classroom

All participants described the benefits of SPOC-based flipped classroom in terms of high performance of in-class laboratory activities. Well-prepared students have the basic knowledge to grasp concrete information, increase their learning efficacy, and are more engaged in activities or laboratory demonstrations. This approach enables more students to enjoy in-class learning and application. As one of the Medical Technology Teachers (MTT) mentioned,

“Since all of them are aware of their participation in the class, they possess a deep understanding of the topic being studied here. They learn how to solve the question and make a discussion. When students enjoyed the face-to-face activities, my class was easy to organize and went so fast. I thought that it is impossible if they do not succeed in their understanding of the contents before” (MTT 08).

In addition, one participant mentioned about the cost of laboratory setting that could be substituted by this reform andragogy. Adults have problem-centered approach for mastery that could be immediately reflected in the application of learning in real life. By engaging in SPOC VDO learning beforehand, students can gain a better understanding of essential

knowledge and minimize errors in the use of reagents and procedures during in-class laboratory activities.

“I agreed with implementing the SPOC-based flipped classroom model because it could encourage students’ learning in special immunological testing that needs particular preparations such as procedures, reagents, and special equipments. Having online videos on the SPOC platform, students would catch up on the essential contents and procedure of special technique, and then achieve it in the in-class activities” (MTT 09).

However, one participant suggested that well-organized in-class activities enhanced students’ learning. MT teachers should develop a unique learning assessment for in-class activities to achieve the course learning outcomes for laboratory sessions.

“I felt that I am able to organize my classroom activities to enhance students’ learning effectively. However, we should have a special evaluation emphasizing students’ learning assessment for in-class laboratory activities to effectively meet the course learning outcomes for laboratory sessions” (MTT 05).

Formative assessment in the SPOC

The SPOC platform was designed to cater to undergraduate medical technology students, providing them with essential knowledge and conceptual tests related to the detection of

immunological reactions and their applications. All participants perceived that having formative assessments freed students for their self-evaluation and provided opportunities for remedial self-improvement. If comprehensive sessions were missed, students could correct their confusion before taking the course examination. As one Medical Technology Teacher (MTT) mentioned,

“When individual students have self-active learning by watching online videos and reading documents via the SPOC platform, they gain fundamental knowledge and can evaluate themselves via pre- and post-tests provided in each topic. This self-assessment may reflect their learning performance and outcomes before having the actual course examination” (MTT 03).

Summative assessment after implementing the SPOC-based flipped classroom

Summative assessment is still necessary for evaluating the effectiveness of the SPOC-based flipped classroom approach. The effectiveness of SPOC is evident in medical technology students who possess a solid knowledge base, as they are able to achieve higher scores in examinations and demonstrate higher-order thinking skills in this specific topic. Likewise, teachers have the ability to assess the increase in student learning outcomes and analyze the success of their reformed teaching pedagogy. As Medical Technology

Teacher (MTT) described it,

“I realized that summative assessments, such as post-test, allow teachers to assess students’ learning outcomes. If students are able to meet the criteria of these assessments, it indicates the effectiveness of the learning materials in SPOC. However, if students do not meet the criteria, teachers should further improve and develop the lessons to assist students in achieving the course learning outcomes” (MTT 09).

“Summative assessment allows us to evaluate that our students have a better understanding and knowledge of certain topics, reflected by higher scores in the course examinations” (MTT 04).

Perceptions toward students’ learning outcomes

Almost all participants (8 of 10) recognized that the initial implementation of the SPOC-based flipped classroom enhanced students’ performance in the knowledge of immunological laboratory testing. Having the SPOC platform as a self-paced online learning tool can help students practice self-regulated learning. Students who prepare themselves before joining in-class activities as active learners can build their competence, learn more quickly, and synchronize their knowledge with tasks related to medical technology careers.

As Medical Technology Teacher (MTT) mentioned,

“I noticed that some students watched the SPOC videos in advance, while others did not. Those who agreed to watch the videos beforehand had questions that could be used as an assessment to determine their level of preparation before attending the face-to-face laboratory sessions. A well-prepared student has relevant knowledge that I can build upon during in-class learning” (MTT 04).

“If students manage their time effectively, they can learn the SPOC online lessons by themselves. After gaining knowledge, they have more time to complete the in-class activities” (MTT 05).

However, other participants (2 of 10) expressed concerns about the passive interaction of the SPOC online learning platform, as students had to engage in self-study. They noticed that students with different backgrounds require active participation in discussions and asking questions. As one Medical Technology Teacher (MTT) pointed out,

“Some students in my groups were not successful in actively learning via the SPOC platform. They forgot their knowledge, and I had to repeat the explanation before continuing the in-class activities” (MTT 02).

Another MTT noted that *“Some students were not familiar with online learning. While studying online, they still needed a teacher to answer their questions or have real-time active participation. This lack of*

understanding made it difficult to lead the in-class activities. Thus, I had to review the material again” (MTT 10).

Difficulties in using the SPOC-based flipped classroom

Although medical technology teachers accepted the benefit of SPOC-based flipped classroom in immunology learning environments, difficulties had been found. Almost all participants (8 of 10) mentioned that it is hard to encourage students to complete the pre-class assignment or participate in all SPOC online sessions. Active students, who had self-learning via SPOC’s online videos, effectively participated in the in-class activities and showed stellar performance. However, students, who did not engage in pre-class preparation, might remain passive during the in-class activities. The complexity of the immunology contents and management of their self-learning time are also challenges for MT students. As one participant expressed concern,

“The most challenging aspect of implementing the SPOC-based flipped classrooms is fostering students’ interest in self-learning platforms like SPOC. They have the potential to gain more knowledge and understanding if they engage in pre-tests, learn the video contents, and complete post-tests for each lesson. In our group, I rely on their cooperation and responsibility. However, I observed that some students

struggled with the critical questions, while others excelled in interactive questions. The main issue was that some students did not study the lesson beforehand, resulting in a lack of basic knowledge required to discuss the questions effectively. Some students also expressed frustration with the complexity of immunological content, which hindered their progress in self-study” (MTT 07).

Likewise, the teachers’ role was changed as an accelerator or guide to stimulate classroom participation in this particular mode. However, one participant complained that this reform teaching is not suitable for Thai student behavior. The teacher realized that motivating passive students to turn into an active mode in classroom participation could make their learning more enjoyable.

“When I posed questions during my class activities, there would be moments of silence before someone answered. I tried to motivate them to engage in the class. It can be challenging to sustain active learning when Thai students tend to be shy in their nature. After their participation in the class, it was difficult for me to gauge their level of knowledge” (MTT 01).

Additionally, one participant noted that the SPOC-based flipped classroom was technologically transformative. The provision of high-quality learning material could potentially alleviate student anxiety in immunology learning. Preparation of effective online teach-

ing materials is difficult because it requires the necessary skills and is time-consuming to produce all the content. However, our teachers' team was less proficient in educational technology or video content production.

"Among our team teachers, I am the youngest lecturer. I have less experience teaching and creating powerful online videos that are qualified in basic knowledge and easy for students to follow their immunology contents" (MTT 09).

Discussions

Since the combination of SPOC and flipped classrooms are setting off a trend in teaching reform of medical education, recently, Mahidol University has supported the development and implementation of SPOC across multiple learning settings via <https://mux.mahidol.ac.th>. Hence, we have initially introduced a SPOC-based flipped classroom curriculum for the detection of immunological reactions and their applications in the basic immunology course. This is because having a strong foundational knowledge of this topic is crucial for students to perform effectively in clinical laboratory testing. Although medical technology teachers who participated in this study had various educational backgrounds and durations of teaching experience, no significant differences were found in their perspectives when implementing the SPOC-based flipped classroom method. This lack of difference may

be attributed to their lack of previous training and practice in this particular approach. Despite the limitation of a small number of medical technology teachers participating in this study ($n = 10$), we were able to gain initial insights into the experiences of medical technology teachers when applying the SPOC-based flipped classroom pedagogy to undergraduate students in the study of immunology. Factors identified here, including motivation, in-class activities, learning evaluation (formative and summative assessment), learning outcome, and difficulties of teaching, could be helpful for further SPOC-based flipped classroom implementation in medical technology education.

In this study, all medical technology teachers agreed on one point: that this reformed teaching mode motivated students' learning in the topic of detection of immunological reactions and applications, in terms of flexibility, interest, and analytical thinking. It may be due to the fact that SPOC platform eliminates the time and space limitations of the traditional teaching model, providing rich learning materials for students to communicate and collaborate anytime and anywhere, creating an open educational environment, and combining the advantages of online courses and face-to-face teaching, which also provides a strong guarantee of flipped classroom knowledge acquisition.⁽¹⁶⁾ In addition, our SPOC platform included pre- and post-test that served as formative assessments to foster individual

learning capacity. Students were required to apply the essential knowledge acquired from the SPOC learning materials in order to complete tasks during in-class learning activities. This approach demonstrated a large effect size and allowed students to actively engage in the flipped classroom perspective.⁽³²⁾ This phenomenon is also supported by recent findings on the SPOC-based flipped classroom approach in clinical hematology courses for undergraduate clinical laboratory technology students⁽¹⁹⁾ and medical immunology studies for medical students.⁽³³⁾ Interestingly, adopting the SPOC-based flipped classroom for immunology courses could reduce the cost of laboratory settings for special tests and was more applicable for laboratory teaching by increasing students knowledge with high engagement in the in-class activities. These findings confirm the underlying theory of blended learning, which combines technological innovation with face-to-face teaching to enhance students' learning processes and outcomes. This suggests that the implementation of SPOC followed by face-to-face learning may facilitate a deeper exploration of course content.⁽³³⁾ Previous research has indicated that the theoretical foundation of blended learning in higher education involves online lessons followed by active learning activities in the classroom, which can encourage Thai students to develop self-regulation behaviors in their learning.⁽³⁴⁾

Although a positive effect on learning

outcomes was found during the reform teaching mode, self-regulated students during active learning via SPOC online, while lacking interaction or communication with the teacher, was observed in this study. It might be due to the promotion of intrinsic regulation and self-determination levels of the students to complete their online sessions before having in-class activities. The self-determination theory supports this observation and explains that the learning environment influences the autonomy motivation to satisfy basic education needs.⁽³⁵⁾ Previously, high autonomy motivation of students was promoted by SPOC-based flipped classroom teaching in physical education by improving the need for competence, autonomy, and relatedness of individuals.⁽³⁶⁾

Assessment is an important tool for monitoring progress toward achieving learning objectives for both teachers and students.⁽³⁷⁾ This study employed formative assessment to evaluate student comprehension during SPOC lessons in immunology studies. Self-evaluation with low stakes allows students to improve their learning efficacy and develop their fundamental knowledge and understanding before attempting the in-class activities. Summative assessment, on the other hand, evaluates students' learning performance and outcomes before the actual course examination or the conclusion of the instructional period. The SPOC platform with related learning materials, particularly simple and practical online videos, likely augmented

students learning, as reflected in the use of formative assessment in this study. In addition, the face-to-face in-class learning activities emphasized laboratory demonstrations, active exploration in the laboratory, and group discussions. These activities strengthened the foundation built by the SPOC and facilitated the completion of tasks in the laboratory. The improvement in students' knowledge of the course content was significant, as seen in the summative assessment in this study. This knowledge of the detection of immunological reactions and applications from the learning materials provided in SPOC to complete in-class tasks was thus introduced in the SPOC-based flipped classroom process. This result aligns with previous findings on the flipped classroom perspective.⁽³⁸⁾ Additionally, since this was the first implementation of SPOC-based flipped classroom module in our faculty and we were not familiar with this reform teaching approach, we designed the SPOC platform specifically for medical technology students to cater to their individual interests and needs. The in-class learning activities placed a strong emphasis on active laboratory investigations, requiring students to apply the foundational knowledge gained from the SPOC materials in order to successfully perform and complete tasks in the laboratory environment. It is worth considering the generation of specific laboratory assessments tailored for in-class activities to further enhance the effectiveness of their application.

Interestingly, inspiring students to participate in online classes or complete the pre-class assignment was identified as a challenge in the teaching reform discussed in this study. One possible explanation is the complexity of delivering immunology content to students with varying backgrounds, making it difficult for individual students to master the subject. Analyzing students' learning performance and their study workload prior to the course would be even more beneficial in improving learning outcomes and fostering student motivation to enjoy the study of immunology. Consequently, teachers need to have a real-time understanding of students' difficulties with SPOC videos in order to better address the challenges and key points of the course. Recent findings suggest an approach to cluster SPOC videos based on their difficulty using video-watching data in a SPOC.⁽³⁹⁾ However, the current study did not perform a difficulty-based clustering analysis of SPOC online videos. Further research could involve real-time data analysis based on existing video-watching data of students, data from different course lessons, and data from various published periods when SPOC-based flipped classrooms will be continuously implemented. It is important to note that this study only assessed the results of a university immunology course.

There are some concerns about the application of SPOC-based flipped classrooms.

Firstly, most Thai students are not familiar with self-online learning and tend to be shy about asking questions in class. To address this issue, we conducted an orientation session for this specific reform teaching approach prior to starting the topic of detection of immunological reactions and applications in the basic immunology course. During this orientation, students were instructed on how to access the SPOC platform, prepare themselves, manage their time for self-directed online learning, and retain the core knowledge for face-to-face classroom activities. The study also provided various learning materials on the SPOC platform appropriate for active learning and divided students into small groups during the face-to-face learning portion to encourage their active exploration of laboratory demonstrations (students: lecturer ratio = 10:1). This character could motivate them to participate in the discussion and problem-solving in the in-class learning activity, as successfully demonstrated in the application of SPOC and team-based learning for dermatology and venereology studies.⁽⁴⁰⁾ Secondly, the MT teachers in this study had different ideas on how SPOC-based flipped classrooms should be conducted and implemented. They were all unsure about how to teach and verify the validity of the reform teaching model. For a more effective implementation, it would have been beneficial for the teacher team to have introduced and prepared themselves with a concrete agreement

on the teaching approach. To address this issue, teacher orientation sessions were conducted, and a unique evaluation form was generated for both online and in-class sessions. These measures were important for assessing the usefulness of the reform pedagogy and establishing a foundation for further study. Despite these challenges, implementing a SPOC-based flipped classroom in this study provided an opportunity to produce effective learning materials that could complete the course learning outcomes and reduce students' anxiety. The results of this study may draw more attention to SPOC-based flipped classrooms and stimulate educational and institutional support for sustainable improvements in teaching and learning for medical technology schools.

Conclusion

Using a phenomenological approach, this study aimed to explore the experiences of medical technology teachers during the implementation of SPOC-based flipped classrooms in the basic immunology course for undergraduate medical technology students, focusing on the detection of immunological reactions and their applications. The results of this study revealed several categories of experience perceived by the medical technology teachers, including 1) motivation of students' learning, 2) enhanced learning outcomes, 3) increased engagement in in-class activities,

4) suitability for laboratory activities and cost reduction, 5) active self-evaluation through knowledge assessment, 6) the opportunity to produce effective learning materials. However, difficulties were also identified in inspiring students to participate in online classes or complete pre-class assignments. The findings of this study may draw attention to the potential benefits of SPOC-based flipped classrooms and encourage educational and institutional support to improve teaching and learning in medical technology schools.

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