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Commentary

Flipped Classroom: An Effective Modality in Nephrology Education

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Kidney disease is a major health care problem in the world. The prevalence of chronic kidney disease is growing, especially in an aging population, which will cause an increasing demand for nephrologists [1]. However, the interest in nephrology careers is declining, largely due to perceptions of nephrology and/or inadequate teaching and training [2-4]. Evidence from The American Society of Nephrology Workforce Committee's Best Practices Project showed that nephrology faculty interaction with medical students, clinical exposure to nephrology and clinical relevance of renal pathophysiology materials, use of novel educational modalities; and exposure, in particular early exposure, to the breadth of nephrology practice contribute to the schools' success and help instill interest in the specialty [5].

Among the novel educational modalities, the Flipped Classroom (FC) represents an ongoing paradigmatic shift in education from teacher-centered to student-centered instructional strategies and it provides the framework where foundational knowledge is acquired independently by a learner prior to a classroom encounter [6]. This knowledge is then applied during face-to-face interactions facilitated by an instructor allowing for higher-level problem solving in class. The FC approach is a highly translatable and flexible model characterized by a wide range of approaches to pre-class assignments, in-class activities and after-class practice. Activities in the class such as simulation sessions, clinical cases, problem-based learning, team-based learning, and discussion activities align well with the values particularly appreciated by the education of the day [7,8].

FC model has been broadly applied across the continuum of medical education ranging from physiology, pharmacology, radiology, emergency medicine and dermatology to other subjects in the past decades [9-13]. We have successfully implemented FC model combined with Case-Based Learning (CBL) in the delivery of glomerular diseases in our students during the clerkship [14]. The fundamental knowledge and facts were concisely incorporated into instructor-generated lecture notes in annotated PPT format, which was provided for the students for pre-learning at his/her own pace at least one week before the class. During the class, with clearly defined objectives, students encountered the real clinical cases which were covered in the preassigned reading materials and were actively involved the interpreting and discussing activities with the guidance of instructors. The immediate feedback, question-answer session as well as the wrap-up summary by the instructor further facilitated the understanding of the learning materials by the students. As expected, students experienced with the FC model demonstrated superior analysis and application ability and a higher adherence to the clinical care algorithms when compared to a control group who received instruction via traditional Lecture-Base Teaching (LBT) [14]. This is consistent with the widely accepted notion that FC is better suited to foster the high-order of abilities than memorize the general facts. Thus, if the teaching aim is to teach high-order Bloom's objectives, such as analysis or application, an FC model seems to be preferred and may lead to greater learningas compared to the LBT.

Nephrology is a laboratory test-based subject and frequently perceived to be too complex among the learners. Compared tolecture-based delivery of knowledge and facts, it is more effective when the learners are prepared with meaningful and interactive pre-work and study in the context of application to real-life situations. Thus, FC combined with CBL is well suited to the features of nephrology. Of note, FC should be started with a clear definition of objectives and all the materials, activities and even assessments should be aligned to achieve the desired objectives, which is called course alignment [15,16]. Any deviation from this alignment can negatively impact learners. Objectives need to be high but achievable to achieve optimal motivation and should be specific, measurable, actionable, relevant and timely [17]. Once the objectives are defined, high-quality of pre-class materials aligned with course goals and matched to learner needs are required to prepare the learners with foundational concepts or facts before the class encounter. The pre-class work should be specifically designed for the FC model and concise, relevant, well organized and delivered by a variety of modalities, including videos, PPTs, handouts or e-resources [7,8,18]. There are few systemic studies assessing the different delivering modalities in terms of efficacy and prevalence. One study reported that high-quality videos

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of approximately 20-30 minutes duration were particularly valued as a means of delivery [18]. In our teaching practice, the annotated PPTs was also an effective means for pre-class delivery. CBL is a well-established pedagogical approach [19]. In view that clinical sciences, including nephrology, are always integrated with clinical presentations and conditions and studied in relation to the cases, CBL seems to be the preferred learning modality during class. When the case is delivered to a small group, it will make the learners take a more active role during their leaning building upon a common foundation. Thereby, FC combined with CBL outperforms traditional LBT in terms of high order cognitive ability acquisition.

Although the FC model is gaining popularity, instructors are still experiencing the growing pains in employing this educational strategy. Firstly, the FC model is expensive in terms of both cost and faculty time, which may be a prime consideration prior to implementing the FC model. In view of the limited sources of funding and support staff, we may make the best of the internet infrastructure to assist in successful implementation. The COVID-19 event has greatly enhanced the development of e-learning technology and platform recently, which makes the e-learning more accessible and applicable to various regions [20,21]. Secondly, while learners generally appreciated the FC combined with CBL model with increased engagement and enjoyment than the didact LBT, they also called attention to the workload of pre-class material to avoid cognitive overload and the following pressure derived from the in-class activities [8]. The burden and pressure may thus compromise the satisfaction with the course. Therefore, optimized the pre-class workload that is suitable for students using the FC approach is important. It is still inconclusive and future studies may be warranted to optimize the time dedicated to the FC approach. Thirdly, creating a safe atmosphere in the class is also critical to encourage students to express themselves and promote the learning outcomes during the in-class learning process. Therefore, to optimize this educational strategy, identifying the research questions is still needed. Well-designed studies, especially the randomized controlled trials from multiple institutes on workload and deliveryof the pre-class learning as well asthe assessment of short-term and long-term effects on the learners' academic performance are greatly needed to advance our understanding on the best practices for FC modality.

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Conflicts of Interest

None

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