Developing an Online Micro-credential Course on Good Prescribing Skill for Undergraduate Medical Students

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Abstract: Prescribing errors are known to account for a substantial proportion of all medication errors which could lead to morbidity and mortality of patients in clinical settings. Considering the number of deaths due to prescribing error, many developed countries such as the United Kingdom have commenced educational assessment to enforce good prescribing techniques to all medical graduates before they start their clinical practice. However, in Malaysia, there is no standardised or specific curriculum or programme that enforces the understanding of prescribing skills and its safety to the undergraduates. As a result, high prescribing errors were seen among housemen and junior medical officers. In view of the current curriculum and related problems, an online micro-credential course on 'Guide to Good Prescribing Skill' was developed by the members of Department of Pharmacology, Faculty of Medicine, UiTM to fill the gap. This paper describes the course development. The course covers the theory behind the importance of good prescribing skills as recommended by WHO and the steps to prescribe drugs according to patient diagnosis. The development of this prescribing skill module will help in giving a structured learning experience to medical students and may improve their readiness and competency when starting real clinical practice after graduation. It is hoped that this course will be an effective way of learning prescribing skills and serve to prevent errors in clinical practice.

Keywords: e-learning, Micro-Credential, Prescribing Skill, Safe Prescribing, Prescribing Errors

1. Introduction

Medications improve human health when they are used correctly. Nevertheless, medication errors remain a prevalent concern in healthcare worldwide as it may cause significant morbidity and mortality (Roberts et al.,2023). Errors can occur during the treatment process, which is during prescribing, dispensing, or during administration of medications to patients (de Araujo et al., 2019). Of all medication errors, prescribing errors are identified as the major cause of medication errors which

cause the most harm (Dean, 2005). Generally, safe prescribing practices include following the 'five rights' of medication use: the right patient, the right drug, the right time, the right dose, and the right route. The risk of prescribing errors occurs when the patient is not identified correctly, the wrong drug is chosen, the timing is off, the dose is wrong, or the route of administration is incorrect. So, observing the "five rights" is a simple way to reduce errors and make sure medications work safely and effectively. In other cases, despite adhering to safe prescribing practices, errors can still occur due to illegible handwriting, use of abbreviation of drug name, which is misinterpreted by another person, the use of incorrect decimal point and lack of knowledge about the patient's condition prior to prescribing a drug.

It is worth noting that the rate and occurrence of medication prescription errors vary across different countries. Nonetheless, a worrying pattern is seen in both hospital and general practice settings, particularly when prescribing medications for older patients with multiple co-morbidities and who are on treatment with several medications (Gupta & Agarwal, 2013). Previous study in the US showed that prescribing errors occurred in 7% of medication orders, while hospital admissions were associated with a 50% rate of prescribing errors, and inpatients had a 2% rate of prescribing errors (Lewis et al., 2009). In another literature, prescribing errors occurred in 0.4 -1.9% of all medication orders and caused harm in 1% of all inpatients (Bates et al., 1995). In the UK, the rate of prescribing error was reported between 7-10% of prescription written by doctors in the first year of clinical practice while the prescribing error rate made by the senior doctors were reported to be around 5% (Dornan et al., 2009; Avery et al., 2012; Ryan et al., 2014).

In Malaysia, a study by Shamsiah et al. reported that errors occurring in primary care settings were under-reported despite the availability of a reporting system and their awareness in knowing that it is important to report medication errors to improve patient safety. This is also contributed by their perception, attitudes towards reporting medication errors, and their familiarity with the reporting system (Shamsiah et al., 2016). Another study conducted at an emergency department of a teaching hospital in Malaysia reported that the most common errors made by doctors were related to dosing and timing (Zayyanu et al., 2020; Shitu et al., 2020). At an obstetrics and gynaecology outpatients of a Malaysian tertiary hospital, it was reported that of 3883 prescriptions screened, 359 (9.2%) prescriptions contained prescribing errors (Narayanan et al., 2022). These mistakes were made mainly by newly qualified doctors who were just starting internships. Possible reasons include lack of knowledge about the prescribed drug, and inadequate undergraduate training in the selection of an appropriate drug suitable for patients' condition. Other factors that contribute to prescribing errors include lack of awareness regarding the importance of having comprehensive patient information and a low recognition of the significance of prescribing (Williams, 2007).

Traditionally, prescribing skill is not commonly taught in an undergraduate medical curriculum. Basic pharmacology is mainly taught in the preclinical years. Applied pharmacology which should include safe prescribing practices may, however, not be adequately covered in clinical years. As a result of the inadequacy in training, students are more prone to making errors when prescribing drugs as a fresh graduate or a newly qualified doctor. Given the significant number of deaths resulting from prescribing errors, several developed countries such as the United Kingdom have implemented mandatory educational assessments on good prescribing techniques for all medical graduates prior to starting their clinical practice (Maxwell et al., 2017).

In contrast to the United Kingdom, Malaysia does not have a specific national curriculum or programme that ensures a comprehensive understanding of prescribing skills and their safety among all Malaysian medical undergraduates. Consequently, there have been noticeable instances of high prescribing errors among houseman and junior medical officers in Malaysia (Samsiah et al., 2016; Ni et al., 2002).

The purpose of developing the micro-credential course is to establish an e-learning platform tailored for undergraduate medical students and newly graduated doctors. The course is designed to equip them with adequate prescribing skills relevant to the healthcare landscape in Malaysia and prepare them for clinical practice. The ultimate goal is for medical students to gain a fundamental understanding of the prescribing process, ensuring they become proficient and safe healthcare practitioners especially in their early years of clinical practice, thereby reducing the occurrence of prescribing errors that can endanger patients. In this paper, we describe the content development of the micro-credential course on 'Guide to Good Prescribing Skill' for undergraduate medical students in UiTM and highlight the evaluation completed by students to improve the online course.

2. Methods

2.1 The Development of Content for a Micro-Credential Course on Guide to Good Prescribing Skills

The micro-credential course on Guide to Good Prescribing Skill was developed by a team of pharmacologists and a medical educationist. It was designed for medical students in their clinical years (Year 3 to Year 5) who have undergone training in different fields in hospitals and primary care clinics. The course covered the 6 steps recommended by the World Health Organization (WHO) for good prescribing skills. This course consisted of 7 important modules and was designed to be completed in 20 hours including pre-assessment and post-assessment tests. The first module introduced medication errors and explained why having good prescribing skills was essential. It also defined key terms like 'prescriber' and 'prescribing error', and its worldwide prevalence. Within this module, there were three teaching videos and two assignment tasks with open-ended questions about the importance of acquiring good prescribing skills and learning from past errors.

The second module, known as "Step 1: Define the Patient's Problem", helps students learn how to recognise the issues patients faced during consultation. Students will learn how to recognise signs and symptoms that can lead to the correct diagnosis through history taking, physical examinations, and careful observation. Students will also learn how to identify disease or disorder, psychological problems, treatment non-adherence, drug dependence or adverse effects of drugs before choosing the appropriate treatment. Students will also understand that not all problems require medications as a first option. Besides that, they will also introduce polypharmacy and its importance in clinical practice.

The third module covers Step 2 named as 'specifies the therapeutic objective'. In this module, students will focus on defining the real problem and determining the treatment goal. Students must know what they aim to achieve with the treatment. Students are provided with teaching videos and exercises to help understand this step.

The fourth module contains Step 3 which is 'verify the suitability of your P-drug'. This module teaches students how to select the P-drug suitable for individual patients. Criteria for selection include diagnosis, drug indication, drug safety, standard dosage, or dose adjustment to be made, duration of treatment, adverse effects or contraindication, drug interactions cost, and convenience. At this step, students will also learn about treatment options without medication, information, advice, and when to consider referral to tertiary hospitals if required.

The fifth module contains Step 4 which is 'start the treatment'. In this module, students will learn what important information to include when prescribing. Students will practice writing prescriptions and identify errors through exercises on different cases. The sixth module covers Step 5 called 'Give information, instructions, and warnings'. This module describes the important information that doctors should share with patients after prescribing a drug. Students are taught that they are required to educate patients on the important information about the prescribed drug, provide clear instructions on the use of drugs, and identify potential warnings that patients may experience when taking the prescribed drug. The students are also taught to inform patients the importance of seeking medical advice should these warnings occur. Students are required to produce a video of their conversation with a patient about the prescribed medications. The seventh module covers Step 6 which is termed as 'Monitor (and stop?) treatment'. This module stresses the importance of monitoring treatment. Students learn to assess the effectiveness of treatment and the next steps to take if the treatment is ineffective. In addition, students also gain knowledge about medications that necessitate long-term monitoring and the factors to consider based on the patient's specific condition. In this module, students will learn when to adjust drug doses based on clinical scenarios.

The course includes short teaching videos of about 3 to 4 minutes of durations each. The teaching and learning materials include real-world case examples and online games corresponding to each module. Formative assessments at the end of each module comprise essay writing, quizzes, multiple-choice questions, case-base questions, video recording of communication with patients where students are required to provide explanation about the treatment, and e-games. This course includes pre-course and post-course assessments. Students who enrolled in the course will be given 20 multiple

choice questions (MCQs) to complete within the stipulated time. Students who achieved more than 80% on their assessments will be considered as passing and awarded a certificate of accomplishment.

2.2 Evaluating the Course Content

To evaluate the suitability of the course, 41 of our Year 4 medical students were invited to enrol in the course and complete all modules within an 8-week period. They were provided with questionnaires to complete at the end of each module. The questionnaires were divided into 3 parts; evaluation of the course content, evaluation of exercises for each module and assessment of knowledge and skill gained. Students used a 5-Likert scale and had a free text field to share their opinion and suggestions. Evaluation of course content covers the relevance of this course to be taught to clinical year students. In the second part, students assessed the course content, exercises and assignments provided for each module. This included their thoughts on the teaching videos, difficulty level of the assignments, and ability to complete the exercises within the specified time frame. The third part of the evaluation focused on whether students felt they gained knowledge, skills and confidence in safe prescribing through this course. Throughout this evaluation process, students had the flexibility to complete the course and provide feedback at their own pace and in their preferred location.

3. Results

From early February 2023 to the end of March 2023 in a total of 8 weeks, 41 students enrolled in the micro-credential course, and all completed the questionnaires. They were Year 4 medical students who have completed medical, surgical, primary care, public health, obstetrics and gynaecology, paediatric and psychiatry. In general, all students agreed, or strongly agreed that the course contents were relevant, and they effectively learned the 6 important steps in drug prescribing as recommended by the WHO. According to the data in Table 1, more than 91% of students reported that they agreed and strongly agreed that course contents of micro-credential are relevant for teaching to clinical year medical students. They realised the importance of acquiring the prescribing skills before working in clinical settings. Students also understood that by acquiring good prescribing skills, they can ensure patient safety, and they can practise as safe and effective doctors.

Table 1

Evaluation of the relevance of the course	Strongly Agreed	Agreed	Neutral	Disagreed	Strongly Disagreed
The course has helped students to understand the 6 steps on good prescribing skills.	65.9%	31.7%	2.4%	0	0
The content is relevant to be taught to medical students.	61%	34.1%	7.3%	0	0
All the contents are relevant.	60.5%	36.8%	2.7%	0	0
I understand the importance of mastering good prescribing skills to be a safe doctor after joining this course.	76.3%	23.7%	0	0	0
This course is more relevant for clinical years students.	81.6%	18.4%	0	0	0

The result of respondents on the relevance of the course (n=41)

Based on the results in Table 2, the contents of all modules were perceived as relevant by more than 90% of respondents. More than 90% students agreed and strongly agreed that the video contents were informative, and of high quality. The duration of the videos for each module was perceived as acceptable. Majority of the students thought that the assignment tasks were fun to do. However, there were varying responses regarding assessment difficulty especially for modules 4 through 7; while 10 to 30% of students agreed and strongly agreed that the assignments were difficult, 20% to 30% of students remained neutral. For the first 3 modules, majority of the students responded that the assignments did not take much time to complete. However, for modules 5 and 6, about 30-50% of students felt that the assignments were taking too much of their study time to complete.

Table 2

Evaluation of teaching contents for all modules (n=41)

Evaluation of teaching content according to module	Strongly agreed	Agreed	neutral	disagreed	Strongly disagreed
Module: Introduction and the importance of prescribing skill					
The contents are relevant.	51.2%	46.3%	2.4%	-	-
The video contents are informative.	53.7%	43.9%	2.4%	-	-
The quality of the videos is good.	56.1%	34.1%	9.8%	-	-
The duration of videos is acceptable	61%	29.3%	9.8%	-	-
The assignment task is fun to do.	36.6%	56.1%	4.9%	2.4%	-
The assignment task is difficult.	9.8%	14.6%	17.1%	48.8%	9.8%
The assignment task takes too much time to complete.	14.6%	17.1%	22%	31.7%	14.6%
In general, this topic is easy.	31.7%	43.9%	22%	2.4%	-
Module: Step 1: Define patient's problem					
The contents are relevant.	51.2%	46.3%	2.4%	-	-
The video contents are informative	53.7%	46.3%	-	-	-
The quality of the videos is good.	52.5%	37.5%	10%	-	-
The duration of videos is acceptable	53.7%	34.1%	12.2%	-	-
The assignment task is fun to do.	34.1%	53.7%	9.8%	2.4%	-
The assignment task is difficult.	7.3%	12.2%	24.4%	43.9%	12.2%
The assignment task takes too much time to complete.	14.6%	14.6%	29.3%	34.1%	7.3%
In general, this topic is easy.	19.5%	43.9%	34.1%	2.4%	-
Module: Step 2: Specify therapeutic objective					
The contents are relevant.	51.2%	41.5%	2.4%	4.9%	-
The video contents are informative	51.2%	39%	4.9%	4.9%	-
The quality of the videos is good.	40%	45%	10%	2.4%	2.4%
The duration of videos is acceptable	43.9%	39%	12.2%	2.4%	2.4%
The assignment task is fun to do.	39%	36.6%	22%	2.4%	-
The assignment task is difficult.	7.3%	12.2%	19.5%	43.9%	17.1%
The assignment task takes too much time to complete.	9.8%	4.9%	24.4%	46.3%	14.6%
In general, this topic is easy.	17.1%	36.6%	39%	7.3%	-
Module: Step 3: Verify suitability of P-drug					
The contents are relevant.	61%	34%	5%	-	-
The video contents are informative	56.1%	39%	4.9%	-	-
The quality of the videos is good.	53.7%	39%	7.3%	-	-

Evaluation of teaching content according to module	**Strongly agreed**	**Agreed**	**neutral**	**disagreed**	**Strongly disagreed**
The duration of videos is acceptable	53.7%	41.5%	4.9%	-	-
The assignment task is fun to do.	41.5%	34.1%	22%	2.4%	-
The assignment task is difficult.	14.6%	9.8%	29.3%	36.6%	9.8%
The assignment task takes too much time to complete.	12.2%	14.6%	34.1%	31.7%	7.3%
In general, this topic is easy.	17.1%	48.8%	22%	12.2%	-
Module: Step 4: Write a prescription					
The contents are relevant.	63.4%	31.7%	4.9%	-	-
The video contents are informative	65.9%	31.7%	2.4%	-	-
The quality of the videos is good.	61%	34.1%	4.9%	-	-
The duration of videos is acceptable	61%	31.7%	7.3%	-	-
The assignment task is fun to do.	68.3%	26.8%	4.9%	-	-
The assignment task is difficult.	12.2%	2.4%	14.6%	46.3%	24.4%
The assignment task takes too much time to complete.	9.8%	7.3%	26.8%	29.3%	26.8%
In general, this topic is easy.	46.3%	41.5%	12.2%	-	-
Module: Step 5: Give information, instruction, and warning					
The contents are relevant.	56.1%	39%	4.9%	-	-
The video contents are informative	53.7%	41.5%	2.4%	2.4%	-
The quality of the videos is good.	53.7%	41.5%	4.9%	-	-
The duration of videos is acceptable	46.3%	39%	14.6%	-	-
The assignment task is fun to do.	31.7%	24.4%	26.85%	7.35%	9.85%
The assignment task is difficult.	17.5%	20%	30%	205	12.5%
The assignment task takes too much time to complete.	24.4%	24.4%	29.3%	12.2%	9.8%
In general, this topic is easy.	34.1%	51.2%	14.6%	-	-
Module: Step 6: Monitor? Stop the treatment					
The contents are relevant.	61%	34.1%	4.9%	-	-
The video contents are informative	58.5%	34.15	4.9%	2.4%	-
The quality of the videos is good.	56.1%	39%	4.9%	-	-
The duration of videos is acceptable	44.7%	44.7%	10.5%	-	-
The assignment task is fun to do.	43.9%	34.1%	19.5%	2.4%	-
The assignment task is difficult.	9.8%	14.6%	29.3%	31.7%	14.6%
The assignment task takes too much time to complete.	17.1%	14.6%	31.7%	24.4%	12.2%
In general, this topic is easy.	41.5%	46.3%	12.2%	-	-

In assessing the effectiveness of this course in imparting prescribing skills to students, all respondents agreed that they acquired the skills of safe prescribing after completing this course. In general, students perceived that this course has successfully educated them on the important steps involved in drug prescribing and had increased their confidence when it came to selecting the most appropriate drug based on the patient's condition. About 94.7% respondents concurred that this course held the potential to aid them in preventing prescribing errors in their future practice.

Based on the evaluation of the effectiveness of this course in delivering prescribing skill knowledge to students, all respondents agreed that they acquired the knowledge of safe prescribing skill after enrolling in this course. In general, students perceive that this course has taught them to understand the important steps in prescribing drugs and boost their confidence in choosing the appropriate drug according to the patient's condition. About 94.7% respondents agreed that this course could help them

in preventing prescribing errors in future. Table 3 summarizes the evaluation of the effectiveness of this course according to the students' perspective.

Table 3

Evaluation of the effectiveness of this course in delivering prescribing skill knowledge based on students' perception

Evaluation of the effectiveness of this course in delivering knowledge	Strongly agreed	Agreed	Neutral	Disagreed	Strongly disagreed
By enrolling in this course, I know the important steps I need to take when prescribing a drug.	63.2%	36.8%	-	-	-
After attending this course, I acquired the skill to prescribe a drug.	39.5%	52.6%	7.9%	-	-
I gained valuable knowledge on how to prescribe a drug from this course.	50%	50%	-	-	-
The course has helped me in understanding how to prescribe a drug and its important matters related to it.	68.4%	31.6%	-	-	-
This course helps me to gain confidence in choosing the appropriate drug.	41.5%	41.5%	17.1%	-	-
This course helps me to prevent making prescribing errors in the future.	52.6%	42.1%	2.6%	2.6%	-

A free-text format was integrated into the questionnaires to enable students to express their opinions, provide suggestions, and highlight any aspects of the course they believe should be changed or enhanced. This format allowed students to offer open and detailed feedback on their experiences and expectations regarding the course. The comments by the students were gathered in Table 4 below.

Table 4

List of comments or suggestions by respondents

Comment/ Suggestion by students
Suggestion to create MCQ at the end of the module instead of short essays as a method of assessment to evaluate the understanding of students. The duration of 8 weeks is insufficient to complete the exercise. Suggest duration of the course to extend to 6 months.
The short quiz at the end of the module helps students to learn and apply the knowledge.
The tasks are interesting but need more time to complete.
Regarding the tasks, the essays are easy but take more time to answer leading to procrastination.
MCQ with answers provided after an attempt is preferred rather than essays for self-assessment.
It is a new topic for me and quite difficult to understand to learn by myself.
The cases require critical thinking.
Lecturer is delayed in giving feedback to the exercise submitted.

The e-game is interesting.

4. Discussion

Prescribing is a challenging task for junior doctors as it requires the skill to diagnose an illness. This task also requires the prescriber to acquire adequate knowledge about medicines, good communication skills, understanding clinical pharmacology and therapeutics principles and making decisions based on experience and judgement (Maxwell & Mucklow, 2012). As more licensed medicine with increasing indications are available nowadays, the treatment regimen has become even more complex, making prescribing even more challenging for doctors (Coleman, 2019).

Despite having an electronic prescribing system in many hospital settings, errors still occur (de Araujo et al., 2019; Alshahrani et al., 2020). Therefore, strengthening the undergraduate curriculum and training on good prescribing skills is key in producing competent and safe doctors (Maxwell et al., 2017). Due to these reasons, it is essential to provide thorough training that will better prepare newly qualified doctors to assume their responsibilities as prescribers. However, incorporating the component of safe prescribing in the medical curriculum remains a significant challenge in modern undergraduate medical education as there is a shortage of specialists (clinical pharmacologists) who can combine clinical pharmacology and therapeutics knowledge with prescribing experience and commitment in teaching (Maxwell & Mucklow, 2012). Additionally, the increasingly busy clinical commitments of the clinical lecturers have possibly resulted in inadequate training of students. Considering all these factors, the development of e-Learning to support safe prescribing presents an opportunity to enhance the learning experience in this critical area.

E-learning is a commonly employed tool to support the learning and training of prescribing skills (Elbeddini et al., 2021). Many available online e-learning resources for prescribing skills are developed for postgraduate doctors by developed countries (Salema et al., 2021). There are also e-learning platforms available for undergraduate students or trainee doctors. However, the subscription fee is considered costly in certain countries. Furthermore, the clinical scenarios and the choice of first line drug can vary between different healthcare settings. For instance, the first line antimicrobial therapy may differ based on sensitivity and antimicrobial resistance (Rocha-Pereira et al., 2015). The prevalence of certain diseases may be different, and the availability of the medications may be different from one country to another. In view of these issues, and the current curriculum, the development of micro-credentials focused on prescribing skills represents a new effort to train medical students in essential aspects of safe prescribing. Apart from that, online learning can foster higher-order-critical thinking skills, which are necessary for the development of effective exercise prescriptions as described by Brahler et al (Brahler et al., 2002).

Developing effective learning materials for this course, such as engaging videos and interesting assignments that provide a positive user experience is considered a challenging task for developers or content experts. It requires the lecturers to master the use of technology and utilise currently available applications into the course content (Alzahrani et. al., 2023). Although time consuming and a great challenge for the lecturers, it is deemed worthwhile as creating effective and engaging teaching videos are more likely to ensure effective learning. Besides that, the current generation of students prefers this approach as they could progress at their own pace and complete the course in due time (Mosca et al., 2019). Students have also expressed positive feedback regarding e-game, which they found interesting. The similar finding was also mentioned by Othman et. al (Othman et. al., 2023). However, according to Abdullah et. al, it is important for the developers to note that the level of ease to use the technology will encourage and motivate the students to complete the online course (Abdullah et. al., 2023).

Based on the feedback received from our students, the teaching videos were satisfactory. However, some students expressed concerns about the exercise tasks at the end of modules. They felt that the essay writing and video assignments were time consuming. As a result, some students suggested incorporating multiple choice questions with answers at the end of each module to allow for self-assessment of their understanding. Based on our findings, we can conclude that students preferred questions with answers at the end of their attempts rather than open ended questions. This preference

aligns with the idea put forth by Barana et al. (2016) that eLearning can be a valuable tool for automatically offering personalized feedback, which is crucial in the implementation of e-Learning.

It's worth noting that some students found the course challenging, particularly those who hadn't previously received instruction on prescribing skills in physical classes. This course represents the first online learning experience for many of our students, as the majority of their education has traditionally taken place in physical classrooms. Nevertheless, this course provides an opportunity for our students to familiarize themselves with online learning as this method has become the primary mode of education at the tertiary level.

Moving forward for improvements, we will seriously consider the suggestion of incorporating formative assessment. This approach hopes to enhance the effectiveness and engagement of their learning process, motivating them to complete the course. On the other hand, the role of formative assessments includes identifying gaps in students' understanding and preparing them for the post-course assessments. The duration of the course of 8 weeks is considered insufficient by our students to complete the course. However, we acknowledge this challenge as our students are busy with their clinical attachments alongside this course. To address this challenge, the course duration may be extended to six months providing students with greater flexibility to progress at their own pace.

5. Conclusion

In conclusion, the proposed micro-credential course presents a promising solution to the persistent challenges in prescribing education within medical training. By prioritizing student feedback and integrating innovative teaching strategies, the course aims to optimize learning outcomes and equip future physicians with essential prescribing competencies. Through continuous refinement and improvement of the micro-credential course contents, medical educators can ensure the course remains relevant and effective in preparing students for the demands of modern healthcare practice. This proactive approach not only addresses the current deficiencies in prescribing education but also contributes to the advancement of medical education and ultimately enhances patient safety. The students' perception of this course and their viewpoints are crucial in ensuring the course contents are suitable for their learning and positive learning outcomes are achieved. It is hoped that this micro-credential course serves as a medium in mastering their prescribing skills and preparing them to become safe and competent doctors for the betterment of our healthcare system.

6. Limitation and Suggestions

The evaluation done by the students was performed by the Year 4 medical students only. In this article, the evaluation of students' performance at pre and post courses was not carried out as the main purpose is to improve the online course based on the students' perception and suggestions. For future study, we recommend that after improvement of the course, all Year 4 students will be recruited to enrol in this micro-credential course and a proper pre- and post-assessments will be conducted to evaluate the effectiveness of this course in educating prescribing skills among our students. A follow up or an audit on prescribing error during internship is recommended to be done to assess their application of knowledge and skills learned from this course.

7. Co-author Contribution

The authors affirmed that there are no competing interests. Author 1 prepared the introduction section, author 2 prepared the method, and author 3,4 and 5 carried out the data analysis and prepared the results. Author 6 and 7 prepared discussion, and author 7 overlooked the writeup of the whole article.

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