Self-Regulated Online Learning Profiles of Medical Students amidst Curriculum Adaptation during COVID-19 Pandemic

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ABSTRACT

Student-centered learning (SCL) is an approach in which the learning process depends significantly on the student. Hence, self-regulated learning (SRL) plays a crucial role in optimising SCL. SRL is defined as active participation in terms of metacognition, motivation, and behaviour during learning. The COVID-19 pandemic greatly impacted education, including medical education, which must adapt by implementing online and blended learning curricula. Thus, there is increasing urgency for both SCL and SRL. This cross-sectional study was performed with medical students at the Faculty of Medicine, Universitas Indonesia, using the Online Self-regulated Learning Questionnaire (OSLQ) to determine the validity and reliability of the OSLQ in the setting of Indonesian medical students and measure their online SRL profiles. We conducted cross-cultural validation, followed by exploratory factor analysis (EFA), quantitative analysis, and qualitative analysis to assess students' SRL and the challenges of online learning environments. A total of 519 participants completed the questionnaire. The EFA confirmed the validity of the questionnaire, which comprised 23 items and five subscales, in the current population (Cronbach alpha = 0.86). Online SRL scores ranged between 65%–77%, with statistically significant differences in all subscales across six different academic years. Preclinical students had a higher level of online SRL compared to clinical students. This study supports the validity and reliability of using OSLQ in the context of Indonesian medical students. Student SRL is a dynamic process that evolves with changing learning contexts. Student support in online learning environments is essential for enhancing student SRL.

Keywords: *Curriculum adaptation, Online learning, Medical education, Self-regulated learning, Student-centered learning*

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INTRODUCTION

Student-centered learning (SCL) is an approach in which teachers do not transmit knowledge directly to students but rather help students construct knowledge themselves. Hence, the responsibility and power in determining the learning process shift from teachers to students. SCL necessitates responsibility, accountability, and autonomy, requiring that students engage actively in their learning process to achieve better understanding (1).

The ongoing COVID-19 pandemic has affected many sectors, including the medical education system. Given the risk of infection, the medical education system must ensure safety of students through adaptation and new sets of rules. One of the most prominent changes observed during the pandemic has been the shift from traditional classrooms to online learning methods. Online learning refers to a learning management system (LMS) used to deliver learning materials without students physically attending classes (2). Although such changes could pose a threat to students' learning experience, it is vital to consider how online learning encourages creativity and innovation in the SCL environment.

Self-regulated learning (SRL) – defined as the active participation of metacognitive skills, motivation, and behaviour during one's own learning – plays a crucial role in optimising SCL. Metacognitive skills refer to the processes of planning, setting goals, organising, self-monitoring and self-evaluating throughout the learning process, all of which enable an individual to be self-aware, knowledgeable and decisive. Motivation includes self-efficacy, self-attribution and an intrinsic interest in the task, while behaviour includes selecting, structuring and creating environments that optimise learning. Another important feature of SRL is the self-oriented feedback loop, which entails a cyclical process of students monitoring the effectiveness of their methods and making decisions

based on this evaluation. Finally, students' interdependent motivational processes represent another important feature of SRL (3). Additionally, SRL can be affected by the educational environment (4). Therefore, the current shift towards online and hybrid learning methods highlights the increasing importance of SRL and SCL as students are required to be more adaptive, resilient and self-regulated. Nevertheless, little is known about the role of SRL profiles in enhancing SCL during the pandemic.

Several instruments have been used to assess student SRL profiles, including the Motivated Strategies for Learning Questionnaire (MSLQ) and the Academic Self-regulated Learning Scale (5–6). However, such tools were designed in a traditional, face-to-face classroom setting and thus may have different implications when exploring SRL in online learning environments due to differing delivery formats.

A recent study by Araka et al. (7) found that the measurement tool of SRL has advanced dramatically from its traditional beginnings and is adaptable to online learning environments. In the online learning setting, the Revised Self-regulated Online Learning Questionnaire (Rev SOL-Q) is a widely used assessment for SRL (8). Recent studies have noted the benefits of Rev SOL-Q in measuring SRL, particularly in Massive Open Online Courses (MOOC), in which students have the full autonomy to control their learning process through self-paced time management (9). Unfortunately, this questionnaire cannot compare some aspects of online learning courses with face-to-face class experiences, such as time management in synchronous courses, classmate interactions and note-taking. However, another tool – the Online Self-regulated Learning Questionnaire (OSLQ) – enables such comparison (8, 10).

The OSLQ was developed by Barnard et al. (10) to assess student SRL in both online and blended learning environments. The OSLQ compares the learning experience in

fully-online courses versus traditional face-to-face classes, making it a suitable tool for measuring student SRL across various settings, including the structured non-self-paced and blended learning delivery modules currently applied in most medical schools. This questionnaire comprises 24 items and includes six subscales of SRL: goal setting, environmental structuring, task strategies, time management, help-seeking and self-evaluation. Responses are measured using a five-point Likert scale ranging from "strongly agree = 5" to "strongly disagree = 1" (10).

The pandemic-related shifts of learning methods to online and blended learning with limited patient exposure necessitate a greater understanding of SRL profile assessment and its role in enhancing SCL in medical students. Therefore, this study investigates the self-regulated online learning profiles of medical students participating in online and blended-learning classes. Our research questions are:

a. Is the adapted OSLQ instrument sufficiently valid and reliable for use in Indonesian medical school with blended learning?

b. How are the online SRL profiles of medical students amidst curriculum adaptation during the COVID-19 pandemic?

MATERIALS AND METHODS

Context

This study was conducted at the Faculty of Medicine Universitas Indonesia (FMUI). Medical education at FMUI involves an undergraduate programme comprising the preclinical stage (first to fourth year) and the clinical stage (fifth to sixth year), with the fourth year representing the transition phase, in which courses cover the foundations of clinical practice and include some clinical exposure.

Throughout the COVID-19 pandemic, learning methods in the Undergraduate Medical Program, FMUI have shifted to a combination of online and offline learning. Most learning experiences for students in preclinical years are conducted online and consist of synchronous lectures, group discussions and practical sessions. Offline learning is conducted for tutorials concerning basic clinical skills only. Conversely, students in clinical years who are completing their clinical clerkships experience a higher proportion of offline learning. In the clinical stage, offline learning includes patient examinations, practical works, emergency simulations, case-based discussions and exams.

Study Design and Participants

A cross-sectional study was conducted using the OSLQ developed by Barnard et al. (10) to compare self-regulated online learning profiles among students of different academic years and to assess the difference between preclinical and clinical medical students. Response options were established using a five-point Likert scale of 1, 2, 3, 4, or 5, corresponding to "strongly disagree," "disagree," "neutral," "agree," or "strongly agree," respectively.

We also investigated qualitative measures using two open-ended questions following the questionnaire, which were, "How do you manage your online courses effectively?" and "What is your biggest obstacle during online courses?"

Instruments

Translation and back translation of the OSLQ

A total of 24 items from the OSLQ were translated from English to Bahasa Indonesia and then back-translated to assess the questionnaire's equivalence with the original version by two experienced translators and medical educationalists from the FMUI. The subscales from the original OSLQ consisted of goal setting (GS 1–5),

environmental structuring (ES 1–4), task strategies (TS 1–4), time management (TM 1–3), help-seeking (HS 1–4), and self-evaluation (SE 1–4), which included 5, 4, 4, 3, 4, and 4 items, respectively.

Pilot study

As part of the validation process, we conducted a pilot study to assess the clarity and relevance of the questions through translation and back-translation, involving students from eight universities in Indonesia. The participants in the pilot study were similar to the targeted population, consisting of preclinical and clinical students.

The pilot study involved 40 non-target participants from eight different medical schools in Indonesia. Following the pilot study, we also completed a cognitive interview to examine the clarity and relevance of the questions. The cognitive interview involved six pilot study participants, of which three were final-year clinical students and three were undergraduate students. After the cognitive interview, subsequent modifications to the bahasa Indonesia version of the questionnaire were made to improve clarity and facilitate appropriate responses. We furthermore analysed the internal consistency of the questionnaire in the pilot study using the Cronbach's alpha reliability index.

Data Collection

A total sampling method for data collection was utilised. The sample consisted of active medical students at the FMUI, ranging from first-year to sixth-year students, with a total of 1,235 students targeted. All respondents voluntarily completed the questionnaires after providing written consent. They were aware that any data they provided would not impact their academic performance. Data collection was conducted using an online questionnaire (Google Forms) between July to August 2021. To increase the response rate, the authors encouraged students to complete the questionnaire during the annual academic evaluation and provided incentives for five randomly selected participants.

Data Analysis

The IBM SPSS Statistics version 24 was used for data analysis. Exploratory factor analysis (EFA) was conducted to determine the latent variables or subscales of OSLQ constructed by strongly correlated items. The factors extraction method used to support the construct validity in this study was principal component analysis. Varimax rotation was selected to produce factor solutions. The results were then interpreted and labelled according to each factor's concept and each item's context. The internal consistency of each subscale was analysed using Cronbach's alpha reliability index.

The results from data collection were then analysed descriptively to check for normality using the Shapiro-Wilk test. Given the abnormal distribution of the data, the non-parametric Kruskal Wallis method was employed to measure the median difference. A significant correlation was considered at $p < 0.05$. The analysis was then followed by a Mann-Whitney test with significance set at $p < 0.005$. Finally, qualitative data from the two open-ended questions were analysed using content analysis, according to the OSLQ subscales.

RESULTS

Study Participants

Out of 1,235 targeted students at the FMUI, 519 (42%) responded to the questionnaire. Of these, 306 were preclinical students and 213 were clinical students. The following represents the number of participants, with the percentage relating to the total number of students in each batch: 120 first-year students (48.7%), 87 second-year students (35.3%), 75 third-year students (35.8%), 19 fourth-year students

(67.8%), 96 fifth-year students (46.1%), and 122 sixth-year students (55.9%).

Pilot Study

After the translation and back-translation process was conducted, the context and content of translated OSLQ material were deemed comparable to the original version. Panel reviews also showed that all items (24 total) were clear and relevant. However, the wording of 7 items (17.5%) was considered unclear and some adjustments were made to improve their clarity.

Pilot study results suggested that the 24 items in this study were clear and relevant to participants' perceptions about SRL. Participants made several suggestions during the cognitive interview for improving the translated OSLQ items, such as giving more detailed activity examples related to the questions. Examples of unclear items are as follows:

a. "I set standards for my assignments in the online course."

b. "I set short-term (daily or weekly) goals as well as long-term goals (monthly or for the semester)."

c. "I read aloud instructional materials posted online to fight against distractions."

d. "Although we do not have to attend daily classes, I still try to distribute my studying time evenly across days."

e. "I communicate with my classmates to find out how I am doing in my online classes."

The authors discussed and revised the wording of unclear items based on participant suggestions. The pilot study's Cronbach's alpha was 0.75 (good and acceptable).

EFA and Reliability

The results showed that the data were adequate for analysis via EFA (Kaiser-Mayer Olkin 0.878 and Bartlett's Test of Sphericity X^2 3488.11, df 254, $p < 0.01$). Correlation matrix results demonstrated that all items had significant correlations with at least one other item (minimum coefficient correlation was 0.3). The sum of all eigenvalues equals the number of variables in the component analysis. An eigenvalue < 1.00 indicates that a component has less variance than a single variable. The generated scree plot inspection showed a clear break after the 5th component (Figure 1).
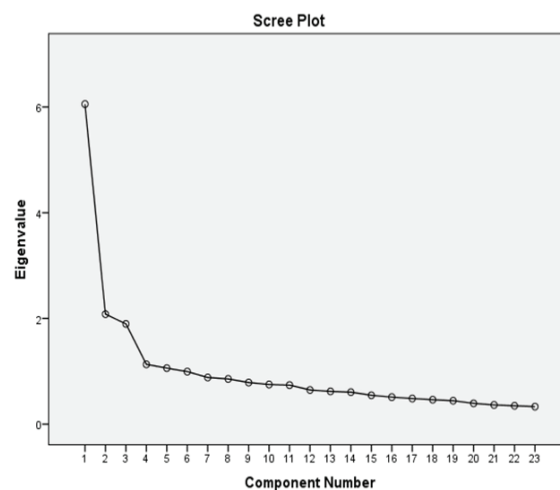

Figure 1: Scree plot.

Furthermore, the principal component analysis method was used to extract the factors. Following principal component analysis, the communalities of each item were considered good. All items were loaded > 0.3. However, an inter-item correlation analysis showed that Item 19 (Help-seeking 3/HS3: "If needed, I try to meet my classmates face-to-face") had a correlation coefficient of less than 0.3. Therefore, Item 19 (HS3) was removed from the analysis.

A varimax rotation was conducted to maximise the loading of items to one factor. The rotated solutions provided adequate results for further interpretation, with all variables loaded > 0.3 on only one factor and no cross-loading onto different factors.

Finally, five factors or subscales were extracted, explaining a total of 53.5% of the variance.

Based on the pattern matrix and constructed factors, the following subscales were formed:

a. Goal setting (6 items)

b. Task strategy (6 items)

c. Support seeking (4 items)

d. Environmental structuring (4 items)

e. Cognitive monitoring and engagement (3 items)

These were then interpreted as described in Table 1.

Table 1: Modified OSLQ

No.	Subscale	Original item subscale	Original question	Translated question	Loading onto factors
1	Goal setting (6 items)	GS1	I set standards for my assignments in online course	*Saya membuat standar untuk tugas-tugas saya selama pembelajaran daring*	0.639
2		GS2	I set short-term (daily or weekly) goals as well as long-term goals (monthly or for the semester	*Saya memiliki target jangka pendek (harian atau mingguan) dan jangka panjang (bulanan atau sepanjang semester)*	0.691
3		GS3	I keep a high standard for my learning in my online courses	*Saya berusaha menerapkan standar yang tinggi dalam menjalani proses pembelajaran daring*	0.656
4		GS4	I set goals to help me manage studying for online courses	*Saya menyusun serangkaian target untuk membantu saya dalam mengelola waktu belajar selama pembelajaran daring*	0.745
5		GS5	I don't compromise the quality of my work because it is online	*Saya tetap mempertahankan kualitas pekerjaan saya meskipun pembelajaran dilaksanakan secara daring*	0.451
6		SE2	I ask myself a lot of questions about the course material when studying for an online course	*Ketika saya sedang belajar untuk kelas daring, saya banyak bertanya kepada diri sendiri tentang materi kelas daring tersebut*	0.445

(Continued on next page)

Table 1: (*Continued*)

No.	Subscale	Original item subscale	Original question	Translated question	Loading onto factors
7	Task strategy (6 items)	TS3	I prepare my questions before joining in the chat room and discussion	*Saya terbiasa mempersiapkan pertanyaan sebelum bergabung dalam diskusi*	0.645
8		TS4	I work extra problems in my online courses in addition to the assigned ones to master the course content	*Selain dari tugas yang diberikan pada kelas daring, saya mengerjakan tugas tambahan untuk dapat menguasai materi*	0.769
9		TM1	I allocate extra studying time for my online courses because I know it is time-demanding	*Saya mengalokasikan waktu belajar tambahan untuk kelas daring karena saya tahu bahwa kelas daring menuntut waktu*	0.593
10		TM2	I try to schedule the same time everyday or every week to study for my online courses, and I observe the schedule	*Saya mencoba menjadwalkan satu waktu tertentu untuk belajar setiap hari atau setiap minggunya, kemudian saya mengamati jadwal tersebut*	0.505
11		TM3	Although we don't have to attend daily classes, I still try to distribute my studying time evenly across days	*Meskipun tidak perlu hadir di kelas setiap hari, saya tetap mencoba mendistribusikan waktu belajar yang merata setiap harinya*	0.436
12		HS4	I am persistent in getting help from instructor through e-mail	*Saya gigih dalam memperoleh bantuan dari instruktur melalui surat elektronik*	0.618
13	Support seeking (4 items)	HS1	I find someone who is knowledgeable in course content so that I can consult with him or her when I need help	*Saya mencari seseorang yang memahami materi dalam pembelajaran daring agar saya dapat berkonsultasi ketika memerlukan bantuan*	0.705
14		HS2	I share my problems with my classmates online so we know what we are struggling with and how to solve our problems	*Saya membagikan masalah saya dengan teman sekelas agar kami dapat mengetahui kesulitan satu sama lain dan mengatasi kesulitan tersebut bersama-sama*	0.729
15		SE 3	I communicate with my classmates to find out how I am doing in my online classes	*Saya berkomunikasi dengan teman sekelas untuk mengetahui keadaan saya dalam menjalani kelas daring*	0.711
16		SE 4	I communicate with my classmates to find out what I am learning that is different from what they are learning	*Saya berkomunikasi dengan teman sekelas untuk mengetahui perbedaan antara apa yang saya pelajari dengan apa yang mereka pelajari*	0.711

Table 1: (*Continued*)

No.	Subscale	Original item subscale	Original question	Translated question	Loading onto factors
17	Environmental structuring (4 items)	ES1	I choose the location where I study to avoid too much distractions	*Selama pembelajaran daring, saya memilih lokasi di mana saya dapat menghindar dari berbagai distraksi*	0.689
18		ES2	I find a comfortable place to study	*Saya sudah memiliki tempat belajar yang nyaman*	0.751
19		ES3	I know where I can study most efficiently for online courses	*Saya mengetahui lokasi di mana saya bisa belajar secara efisien selama pembelajaran daring*	0.739
20		ES4	I choose a time with few distractions for studying for my online courses	*Saya memilih waktu yang minim distraksi untuk belajar selama mengikuti kelas daring*	0.527
21	Cognitive monitoring and engagement (3 items)	TS1	I try to take more thorough notes for my online courses because notes are even more important for learning online than in a regular classroom	*Saya berusaha untuk mencatat dengan seksama selama pembelajaran karena catatan berperan sangat penting dalam pembelajaran daring dibandingkan pembelajaran konvensional*	0.737
22		TS2	I read aloud instructional materials posted online to fight against distractions	Saya membaca dengan keras instruksi dan materi yang tertera pada kelas daring untuk melawan distraksi	0.670
23		SE 1	I summarise my learning in online courses to examine my understanding of what I have learned	*Saya merangkum apa yang telah saya pelajari dari kelas daring untuk dapat menilai pemahaman saya akan apa yang telah saya pelajari*	0.625

The reliability of each subscale was assessed using Cronbach's alpha, and the results were considered good. The reliability coefficients for goal setting, task strategy, support seeking, environmental structuring, and cognitive monitoring and engagement were 0.77, 0.77, 0.75, 0.67, and 0.62, respectively. Cronbach's alpha coefficient for the total scale was 0.86 (very good) and the total correlation of Cronbach's alpha indicated that the questionnaire had good construct validity.

Profiles of Online SRL

The Shapiro-Wilk test suggested that most of the data were not normally distributed. Thus, the differences of each year in each subscale were analysed using the Kruskal Wallis methods, as depicted in Table 2.

The total SRL score results showed that the third-year students had the lowest SRL score (65% of the maximum score), while the first-year and fourth-year students had the highest score (77%). The trend showed lower SRL scores among third-year students and a noticeably higher score in fourth-year students that remained stable among fifth-year and sixth-year students. A non-parametric test showed that total scores in the six subscales differed significantly across six different academic years ($p < 0.01$).

In this study, third-year students consistently had the lowest score in three domains: task strategy, support seeking, and cognitive monitoring and engagement. Meanwhile, fourth-year students had the highest score in four domains: goal setting, task strategy, support seeking, and cognitive

Table 2: Profiles of online SRL

Study participants	Goal setting (Max score: 30)		Task strategy (Max score: 30)		Support seeking (Max score: 20)		Environmental structuring (Max score: 20)		Cognitive monitoring and engagement (Max score: 15)		Total score (Max: 115)
	Median (Int. range)	p-value	Median (Int. range)	p-value	Median (Int. range)	p-value	Median (Int. range)	p-value	Median (Int. range)	p-value	Median (% from the maximum score)
First-year	23 (5)	<0.01**	18 (6)	<0.01**	15 (5)	<0.01**	17 (3)	<0.01**	10 (4)	<0.01**	84 (73%)
Second-year	23 (6)		16 (6)		15 (4)		18 (4)		9 (5)		81 (70%)
Third-year	22 (6)		16 (6)		13 (6)		17 (4)		7 (3)		75 (65%)
Fourth-year	24 (6)		18 (6)		15 (4)		17 (3)		10 (4)		84 (73%)
Fifth-year	21 (5)		17 (5)		15 (3)		16 (3)		9 (4)		80 (70%)
Sixth-year	22 (5)		17.5 (6)		15 (4)		16 (4)		9 (4)		79 (70%)

Notes: *Posthoc Mann-Whitney test; p is significant at 0.005 or less

- Goal setting: First-year and third-year Mann Whitney U 3426.5; p 0.005, First-year and fifth-year Mann Whitney U 4032.5; p 0.005; p 0.000*, First-year and sixth-year Mann Whitney U 5145.5; p 0.000*, Second-year and fifth-year Mann Whitney U 3173.5; p 0.005, Second-year and sixth-year Mann Whitney U 4068.5; p 0.004*

- Task strategy: First-year and third-year Mann Whitney U 3049.5; p 0.000, third-year and fifth-year Mann Whitney U 2530.5; p 0.001, third-year and sixth-year Mann Whitney U 3242.0; p 0.001

- Support seeking: First-year and third-year Mann Whitney U 2659.5; p 0.000, second-year and third-year Mann Whitney U 1981.5; p 0.000, Third-year and fifth-year Mann Whitney U 2581; p 0.001, third-year and sixth-year Mann Whitney U 3153; p 0.000

- Environmental structuring: first-year and fifth-year Mann Whitney U 4002.5; p 0.000, first-year and sixth-year Mann Whitney U 5342; p 0.000, second-year and fifth-year Mann Whitney U 3117.0; p 0.003

- Cognitive monitoring and engagement: first-year and third-year Mann Whitney U 2304; p 0.000, first-year and fifth-year Mann Whitney U 4446.5; p 0.004, first-year and sixth-year Mann Whitney U 5761.5; p 0.004, second-year and third-year Mann Whitney U 2107.5; p 0.000, third-year and fifth-year Mann Whitney U 2532.5; p 0.001, third-year and sixth-year Mann Whitney U 3190.5; p 0.000

monitoring and engagement. Second-year students achieved the highest score in environmental structuring.

When students were categorised based on their study phase (preclinical vs. clinical), results showed that preclinical students had a higher score (median: 82.5, 72%) than clinical year students (median: 79.5, 69%). However, significant differences were only found in the subscales goal setting ($p < 0.01$) and environmental structuring ($p < 0.01$).

Qualitative Analysis

There were two open-ended questions answered in this study: "How do you manage your online courses effectively?" and "What is your biggest obstacle during online courses?" We categorised answers into the modified OSLQ subscales used in this study, namely, goal setting, task strategy, support seeking, environmental structuring, and cognitive monitoring and engagement. These are some of the results to the first open-ended question, "How do you manage your online courses effectively?"

a. Goal setting

Goal setting refers to specifying intended actions or outcomes, including setting standards for assignments, setting short and long-term goals, and double-checking work to ensure quality (10). Several participants reported making study targets, such as the following:

Allocating time to study with minimum distraction as well as goal setting beforehand. (PG, second-year student)

Setting targets and then evaluating them. (RH, third-year student)

Setting learning targets in accordance with the SKDI (the competency

standards of Indonesian doctors). (AM, sixth-year student)

b. Task strategy

Task strategy includes analysing tasks and identifying specific advantageous methods for learning (10). After setting goals, some students plan what they will do to achieve their goals. For example:

Preparing myself (including looking neat for an online class), reading the materials beforehand, allocating a specific undisturbed time to study, and drinking coffee. (H, first-year student)

Making daily and weekly schedules. (DN, second-year student)

Reading the materials one day before the session and preparing questions to be asked during discussions. (AS, sixth-year student)

c. Support seeking

Support seeking includes sharing problems, communicating with classmates, and finding someone who is considered knowledgeable to consult with regarding confusion or misunderstanding. For example:

Keeping a good support system that helps me feel less lonely during the online course. (IR, first-year student)

Seeking support system from friends and supervisors. (AS, fifth-year student)

Asking friends about materials. (GAW, fifth-year student)

d. Environmental structuring

Many respondents look for and prepare comfortable places to effectively participate in online courses. Here are a few examples of participants' responses:

> Looking for a comfortable place to study with a stable internet connection. (APM, fifth-year student)

> Looking for a comfortable place with minimum external distractions. (CP, fifth-year student)

> If possible, I choose to study at a coffee shop to avoid the boredom of staying at home for too long. Aside from that, I also set daily schedules, including time to study. (MW, fourth-year student)

e. Cognitive monitoring and engagement

Cognitive monitoring and engagement include activities that help students stay focused during online courses. For example:

> I try to take notes so that I don't get distracted, I also review lessons by reading my notes aloud. (NR, first-year student)

> I take notes and I follow the discussions actively to maintain my focus. (AJ, second-year student)

> I focus during class and discussions by taking notes. (KTP, sixth-year student)

The second open-ended question, "What is your biggest obstacle during online courses?" was categorised into external and internal factors. More students addressed external factors than internal factors as the following examples are provided:

a. Internal factors

Some of the internal factors stated by participants concerned health and boredom related to online learning: "laziness" (M, first-year student), "boredom" (GT, first-year student) and "health." (DR, fifth-year student)

b. External factors

According to the responses, external factors more frequently posed obstacles during online courses. Some answers concerned internet connection, while most clinical students identified the lack of clinical experience and patient exposure as their primary obstacle. Here are a few of the responses:

> Unstable internet connection and the need for more internet quota. (PAW, fifth-year student)

> Not applicable on patients, which makes it hard to picture the needed skills, including skill on patient history taking and physical examination. (A, fifth-year medical student)

> Unstable internet connection, fatigue due to too much use of gadgets. (FN, third-year medical student)

DISCUSSION

With the rising urgency of SRL in improving SCL during the COVID-19 pandemic, this study aimed to investigate the SRL profiles of Indonesian medical students and the study challenges arising from current curriculum shifts. Given the comprehensiveness and relevancy of the

content for the online and blended learning environment with various synchronous activities, the OSLQ developed by Barnard et al. (10) was used to analyse students' online SRL profiles.

EFA revealed that the instrument adapted for this study had good validity and reliability. There were significant differences between the original OSLQ and the current, modified OSLQ. The original questionnaire consisted of 24 items, while the modified OSLQ had only 23 items. Evaluation of the correlation matrix showed that almost all items had significant correlations with at least one other item, with a minimum correlation coefficient of 0.3 and $p < 0.01$, except for one item (help-seeking 3: "If needed, I try to meet my classmates face-to-face"), which was removed due to its low correlation coefficient (< 0.3). We suggest that this item is irrelevant in the setting of the COVID-19 pandemic, as it concerns face-to-face interaction between classmates. Given ongoing efforts to socially distance and thus minimise disease transmission, it makes sense that participants would avoid face-to-face interactions when seeking help from their peers.

Furthermore, principal component analysis identified five factors retained during the construction of the modified-OSLQ subscales. All variables loaded relatively high (> 0.3) on only one factor and were thus interpreted as having similar constructs (11). Ultimately, five subscales were formed and subsequently named by the authors according to the phases of SRL. The subscales were different from those of the original OSLQ, which has six subscales.

Based on the theoretical framework by Zimmerman regarding SRL, which involves dimensions of forethought, performance and self-reflection phases, the subscales in the current questionnaire illustrated the theories adequately (Figure 2) (12).

To the authors' best knowledge, this was the first study to investigate the profile of SRL in Indonesian medical students and specifically in an online learning environment during the COVID-19 pandemic. The current study showed that all participants had moderate levels of online SRL (65%–73% of the maximum score), with the lowest SRL score found in third-year students and the highest SRL score found in first- and fourth-year students.

The development of SRL is a dynamic, proactive process that evolves as the context of students' learning changes (10). When considering the study phase, we found that preclinical students showed higher online SRL scores than clinical students. However, significant differences were found only in the subscales goal setting ($p < 0.01$) and environmental structuring ($p < 0.01$). A previous study from Barbosa et al. (13) suggested that an optimal academic workload determines students' SRL. The relatively high academic workload among clinical year students may also be a factor influencing SRL scores among the two stages of medical education.

This is further supported by Greviana et al. (9), who reported that a higher workload produces a lower SRL score in internship doctors working inside versus outside the Java-Bali Region.
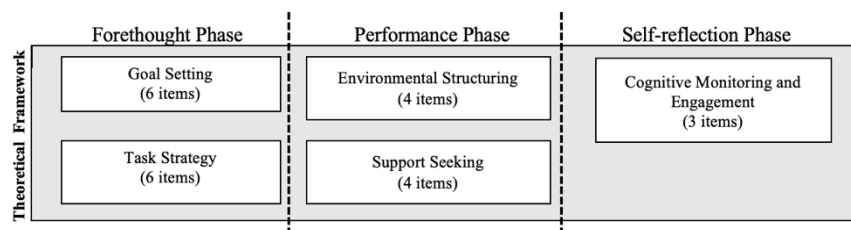

Figure 2: Theoretical framework.

Fourth-year students had the highest score across all domains except one, environmental structuring. This may be because the fourth-year students represent a transition from the preclinical to clinical phase in our medical curriculum, which includes courses with more flexible schedules than those in earlier years. Additionally, fourth-year students have also started preparing for their clinical years and have been exposed to some clinical routines, such as patient examination and case-based studies.

The environmental structuring subscale yielded the highest scores among second-year students, which could relate to the established adaptation of second-year students to the medical education environment compared to first-year students. The qualitative data showed that environmental structuring efforts in this study consisted of setting up a comfortable study place and getting rid of potential distractions during online classes.

Third-year students had the lowest SRL scores in most subscales and the lowest total SRL score. Internal motivation is an essential stimulus for developing SRL and demonstrating better academic performance. Conversely, stress, anxiety, hopelessness, and lack of motivation are obstacles to implementing SRL (14). A study from Artuch-Garde et al. (15) stated that SRL also influenced the level of resilience. Our findings were also supported by highlights from Findyartini et al.'s (16) study, in which third-year students' resilience was lower than first-, second-, and fifth-year students. Additionally, Hojat et al. (17) found that third-year students experienced the erosion of empathy influenced by several factors, such as lack of role models, time pressure, a high volume of materials to learn, and patient and environmental factors.

A high level of SRL has been reported to significantly benefit students' academic performance. It is positively associated with academic achievement and clinical ability and negatively associated with the incidence of depression. Furthermore, it is known that for medical students in a clinical environment, developing SRL can yield long-term benefits, such as clinical skills development and the provision of effective services to patients. Thus, it is recommended that medical schools promote the theory and application of SRL to students using a structured SRL framework with three phases: forethought, performance and self-reflection (18–20).

This study provides evidence regarding the current situation of medical students' online SRL profiles, which are categorised at a moderate level. Medical schools can provide appropriate support during online learning environments by identifying students' SRL. Special attention to promoting and encouraging SRL should be taken, especially for third-year students, who had the lowest SRL scores in this study. Students' SRL is highly driven by their motivation beliefs, especially in the forethought phase, during which students set goals and plan proper strategies for their studies. Recently, early clinical exposure was proposed as an effective factor for increasing student motivation and encouraging students to learn professional behaviour beginning in their preclinical years. Early exposure to clinical rotations, doctor shadowing, patient demonstration, and case-based discussions are several approaches that can be used with preclinical students to improve their SRL (21).

To help clinical students achieve an excellent SRL level, medical schools can increase students' motivation, goal setting and self-efficacy by reminding them of their responsibilities as future doctors. Additionally, students should be encouraged to attend classes with good concentration, focus on understanding the material (vs. memorising), be aware of learning needs, and create effective, individual learning strategies. The presence of feedback, formative exams, and role models can also improve clinical students' SRL (20).

Content analysis of the responses to the two open-ended questions showed that students employ different strategies across the five aspects of SRL. Most students rely on a mixture of the subscales and do not rely exclusively on one strategy. We found that the domains task strategy and cognitive monitoring and engagement were frequently found within participant answers. The combination of prompts and feedback significantly increased SRL strategies and learning outcomes, especially in the performance phase (22). However, the self-reflection phase was among the least mentioned.

Self-reflection represents an essential aspect of SRL and is beneficial for both therapeutic relationships and professional expertise. Self-reflection can be understood as a metacognitive process that occurs before, during, and after situations to develop a better understanding of both the self and the situation to better prepare for future encounters with similar situations (23). Self-reflection can help students evaluate the gap between their goals and performance. However, this may require the support of another person, such as a supervisor, to provide supportive environments and challenge students by offering different perspectives, better known as guided reflection (24). Medical schools can support students' SRL by assigning lecturers as mentors and providing more opportunities to practice routine guided reflections.

Internet connection was the external factor most frequently mentioned as an obstacle during online learning. As online learning has been necessary for several months, many students have returned to their hometowns. Unfortunately, some areas experience limited internet access, making students struggle to keep up with their learning, which requires a good internet connection. Several previous studies have also reported limited internet access as an obstacle to online learning (25–26). It is essential for the faculty, especially the module team, to provide various learning media (e.g., minimising synchronous live streaming sessions and providing more references or reading assignments) to minimise bandwidth usage.

Another external factor mentioned as an obstacle to online learning was the lack of clinical experience, as students' exposure to patients is limited. Hence, their opportunities to hone their history-taking and physical examination skills are finite, making it difficult to imagine actual clinical situations. According to Kolb's learning theory, human interaction, meeting patients, and other clinical exposures are inseparable from clinical learning. Such clinical experiences trigger students to integrate their previous knowledge and conceptualise hospital-based experiences, leading to improvement in their decision-making skills and professionalism (27–28). Providing a safe learning environment is necessary to ensure that students have sufficient opportunities to observe and be involved in clinical practice. Procurement of personal protective equipment, strict hours of clinical placement, and the inclusion of students in telemedicine are recommended to provide hands-on experience within a safe environment.

LIMITATIONS

This study's limitations include limited generalisability, as this study involved single-centre research. The response rate was also low, and the amount of blended learning in the analysis could not be assessed due to the second wave of COVID-19 in Indonesia that occurred during data collection. Moreover, the OSLQ is a self-reported questionnaire; thus, participants could potentially have provided invalid answers or encountered social desirability bias. However, as participants were aware that this study was anonymous, we could reasonably expect honest responses. The study design furthermore did not allow the authors to explore causal relationships between SRL profiles and online learning environments, nor could they explore longitudinal changes in the profiles.

We suggest further research exploring SRL profiles among Indonesian medical students using this validated and adapted OSLQ, as well as their correlation to other parameters such as student motivation, self-resilience, self-confidence, and empathy. Finally, investigating heterogeneous samples in a multi-centre study would show whether our results are valid for other populations of medical students.

CONCLUSION

The present study provides validity and reliability evidence for using OSLQ in online learning environments for Indonesian medical students following several modifications, including subscale renaming and the removal of an item. The current, modified OSLQ comprised 23 items and five subscales (goal setting, task strategy, support seeking, environmental structuring, and cognitive monitoring and engagement), with the overall Cronbach's alpha being 0.86 (very good).

The results showed that participants had moderate levels of online SRL (65%–77% of the maximum score). The total scores in all subscales differed significantly across six different academic years. The highest total SRL score was found in first- and fourth-year students, while the lowest total SRL score was found in third-year students. Overall, preclinical students had a higher total SRL score than clinical year students, with significant differences found only in the goal setting and environmental structuring subscales. Qualitative results showed that students apply several SRL strategies. Student SRL is a dynamic process that evolves as the learning context changes. We recommend that medical schools promote and support both the theory and application of SRL to students in online learning environments.

ETHICAL APPROVAL

The study was approved by the Research Ethical Committee of the Faculty of Medicine Universitas Indonesia (KET-701/UN2.F1/ETIK/PPM.00.02/2021).

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