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Perceptions of Self-directed Learning among Preclinical Medical Students at Universiti Teknologi MARA

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ABSTRACT

Self-directed learning (SDL) is an important aspect of lifelong learning. Medical knowledge is constantly changing, so, medical students need good SDL abilities to ensure improvement in their academic performance and future work service. This study aimed to evaluate the perceptions of SDL abilities among preclinical medical students at Universiti Teknologi MARA and identify the factors that motivated or discouraged them to undertake SDL. A validated 20-item SDL instrument (SDLI) was used to assess the SDL abilities of the students. They were also asked to respond to open-ended questions about the influencing factors in implementing SDL. The 232 respondents were comprised of Year 1 and Year 2 medical students. The mean SDLI scores of the respondents were higher than those obtained in other studies using the same instrument, indicating these respondents had good SDL abilities. No significant differences in SDLI scores were identified in terms of gender, academic background, or academic year. Important promoting factors for implementing SDL reports included guidance from lecturers or faculty, as well as support from friends and family. Distractions from current technology and social media were listed as significant discouraging factors for implementing SDL. The influencing factors reported in this study should assist the faculty in designing appropriate teaching-learning activities that guide and support SDL.

Keywords: *Self-directed learning, SDL abilities, Perception, Preclinical student, Lifelong learning*

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INTRODUCTION

Self-directed learning (SDL) originated with Knowles (1), who defined SDL as “the students take initiative with or without the help of others, assess their learning needs, formulate goals with the implementation of appropriate strategies and evaluate learning outcomes”. Evidence from the literature suggests that SDL plays a positive role in enhancing the personal and professional development of healthcare professionals (2, 3). Academic performance was higher among health science-based students with good SDL skills (4, 5). Students having

good SDL skills are associated with improved student-teacher engagement (6), better self-leadership (7), and enhanced communication skills (8). Similarly, for practising physicians and healthcare professionals, good SDL skills are associated with higher professional competence (3, 9).

Therefore, medical students are expected to possess SDL skills (10) as they need to continuously equip themselves with relevant knowledge and skills in the fast-evolving world of medicine. SDL means that students take the initiative to learn whereby they themselves have the primary responsibility to plan, implement, and evaluate their learning strategies (11). The perceptions of SDL abilities or readiness among medical students have been widely reported in the literature. Some studies have reported moderate SDL abilities (4, 12) whereas some have reported high SDL abilities (13–15) among medical students. Yang et al. (4) observed moderate SDL abilities among students from five medical schools in China with no significant difference identified between the abilities of undergraduate and postgraduate students. However, the researchers reported that higher SDL abilities were associated with better academic performance, which contrast directly with the outcomes of several other studies in which no association was found between SDL abilities and academic performance (12, 16). Meanwhile, Kidane et al. (14) reported higher SDL abilities among senior medical students from Ethiopian medical schools compared to their junior counterparts. This data suggested that better SDL abilities were associated with the learning experience within the medical curriculum. SDL abilities or readiness have also been reported to decline as students advance through their years of study (4, 12, 17). This decline might be associated with the increasing burden of the medical curriculum over the course of time. Meanwhile, other studies reported no significant differences between SDL abilities or readiness and the year of study (18, 19).

Inconsistent results concerning SDL abilities among medical students were also found in students in other healthcare professions (5, 20, 21). These inconsistencies were explained by differences in personality traits, maturity or age, upbringing environment, culture, educational background, as well as the type of curriculum the students were experiencing at the time of research (17, 20). Otherwise, support received from families, friends and the faculty might influence the SDL skills (22). Ricotta et al. (10) conceptualised the attributes that influence SDL in the medical education context, which include personal attributes, as well as the institutional environment, assessment, pedagogy and faculty development. Meanwhile, internal and external motivations were recognised as the drivers that energised those attributes in respect of SDL.

Developing good SDL skills allows students to be confident and shape their own future career pathway (23). They will be aware of their own learning needs and can therefore decide how far they would like to go and how they will achieve their aims. This explains why SDL has close associations with life-long learning, which forms a mutual basis to one another. Other than these close associations, having good SDL abilities would also improve one's quality of life-long learning (24), which would make individuals more satisfied with their learning (25).

Alongside the benefits of the SDL mentioned above, SDL abilities are crucial in preparing medical students for becoming competent doctors. They also influence professional quality and growth once the graduate enters the workplace. Without adequate or proper SDL abilities, medical graduates may fall behind if they practise using only the knowledge gained during their medical school years. Like in other Asian countries, the curricula in Malaysia's primary schools, secondary schools and matriculation are teacher-centred and centralised towards public examinations (26). In contrast, the curriculum changes in university settings to become more student-centred. This transition period may affect the SDL abilities or

readiness of preclinical medical students. Therefore, the aims of this study were to evaluate the SDL abilities of preclinical medical students in Universiti Teknologi MARA (UiTM) and determine the factors that influence these SDL abilities. Although many research studies have been conducted on SDL abilities, it was important to identify the factors that might influence the aforementioned variations among Malaysian medical students, specifically during their early years at medical school. By identifying the influencing factors, the faculty could design the curriculum, facilities, and resources accordingly to promote SDL among the students.

METHODS

The data for this research was collected in July 2022. The validated 20-item SDL instrument (SDLI) questionnaire developed by Cheng et al. (27) was used to determine the levels of SDL abilities among the students. The SDLI is a self-report instrument containing four domains: learning motivation, planning and implementing, self-monitoring, and interpersonal communication (Table 1). The SDLI uses a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The potential total score achievable for the SDLI ranges from 20 to 100. Additionally, three open-ended questions adapted from Premkumar et al. (17) were used to determine perceptions of what promotes or deters SDL among these students. These questions were as follows: (a) What do you understand about SDL?; (b) What is/are the important promoting factor(s) to ensure the effectiveness of SDL? and (c) What challenge(s) might deter the effectiveness of SDL?

Firstly, face validation of the questionnaire was conducted with five students to check their comprehension and understanding of the said questionnaire. Then, a pilot study involving 30 students was undertaken prior to the actual study, whereby the reliability of the overall questionnaire using Cronbach's alpha was found to be 0.93.

Based on the sample size calculated using Raosoft (www.raosoft.com/sample_size.html) using 5% margin of error, 95% level of confidence and 50% of response distribution, the recommended sample size was 215 respondents. Convenience sampling was used in this study and the questionnaire was distributed to all Year 1 and Year 2 medical students at Faculty of Medicine (FOM), UiTM via an online survey (Google Forms). Students were invited to participate in this research study through email and WhatsApp platform. Details of the study and information for participants were included on the first page of the online form, and the consent of each individual was considered to have been obtained when they clicked on the "agree" button to proceed to answer the questionnaire. Students in the clinical years (Years 3 to 5) were excluded from this study.

The quantitative data was analysed using the Statistical Packages for Social Science (SPSS), version 26.0. The demographic profile data was illustrated using descriptive statistics. The mean + standard deviations were reported for the SDL abilities. The student *t*-test or ANOVA, depending on the groups for dependent variables, were used to determine the statistical differences between the total scores for SDL abilities and the demographic profile. Statistical significance was considered at $p > 0.05$. The answers to the open-ended questions were examined and analysed via thematic analysis. The data was examined repeatedly by the authors to identify codes, which were then revised and grouped into themes.

Table 1: Details of the items in SDLI

Domain	Items
Learning motivation	<p>I know what I need to learn.</p> <p>Regardless of the results or effectiveness of my learning, I still like learning.</p> <p>I strongly hope to constantly improve and excel in my learning.</p> <p>My successes and failures inspire me to continue learning.</p> <p>I enjoy finding answers to questions.</p> <p>I will not give up learning just because I face some difficulties.</p>
Planning and implementation	<p>I can pro-actively establish my learning goals.</p> <p>I know what learning strategies are appropriate for me in reaching my learning goals.</p> <p>I set the priorities of my learning.</p> <p>Whether in the clinical practicum, the classroom or on my own, I am able to follow my own plan of learning.</p> <p>I am good at arranging and controlling my learning time.</p> <p>I know how to find resources for my learning.</p>
Self-monitoring	<p>I can connect new knowledge with my own personal experiences.</p> <p>I understand the strengths and weaknesses of my learning.</p> <p>I can monitor my learning progress.</p> <p>I can evaluate my learning outcomes independently.</p>
Interpersonal communication	<p>My interaction with others helps me plan for further learning.</p> <p>I would like to learn the language and culture of those with whom I frequently interact.</p> <p>I am able to express messages effectively in oral presentations.</p> <p>I am able to communicate messages effectively in writing.</p>

RESULTS

Demographic Characteristics of the Respondents

A total of 474 students, all of whom were Year 1 and Year 2 medical students at FOM, UiTM were invited to participate in the questionnaire. Of the 474, 35 students participated in the face validation and pilot study, so they were not qualified to participate in the actual study.

Of the remaining 439 students, only 232 of them participated in answering the questionnaire, which is equivalent to 52.8%. The number of respondents exceeded the required sample size of 215 respondents. Of the respondents, 69.83% were female students and 30.17% were male students. This corresponds to approximate 70:30 ratio of female to male students at FOM, UiTM. Most respondents had ASASI or matriculation (93.1%) as their highest pre-degree qualification. The remaining 6.9% had either a diploma (6.03%) or a degree (0.87%) as their highest pre-degree qualification. More Year 1 students (52.59%) than Year 2 students (47.41%) responded.

SDLI Scores

The mean total SDLI score among the Year 1 and Year 2 medical students at the FOM, UiTM was 80.78 ± 9.36 , which was considered to reflect high SDL abilities compared to the outcomes from other studies that used the same instrument (27). No significant difference

was observed in the total SDLI score and the scores in specific domains of the respondents, based on the variations in academic year, gender, and highest pre-degree education level (Table 2).

Table 2: The SDLI scores according to the demographic characteristics of the respondents

Variable	N (%)	LM	PI	SM	IC	Total SDL
Total participants	232	25.74 ± 3.08	22.98 ± 3.81	15.92 ± 2.36	16.14 ± 2.35	80.78 ± 9.36
Gender						
Male	70	26.03 ± 3.59	23.34 ± 4.39	16.40 ± 2.60	16.26 ± 2.86	82.03 ± 10.41
Female	162	25.62 ± 2.84	22.82 ± 3.53	15.72 ± 2.22	16.09 ± 2.11	80.25 ± 8.85
t-test		t = 0.93 p = 0.352	t = 0.88 p = 0.191	t = 1.92 p = 0.058	t = 0.43 p = 0.67	t = 1.33 p = 0.184
Highest level of education						
ASASI/ Matriculation	216	25.72 ± 3.11	22.99 ± 3.85	15.97 ± 2.35	16.16 ± 2.37	80.84 ± 9.42
Diploma	14	26.00 ± 2.8	22.50 ± 3.37	15.50 ± 2.59	16.00 ± 2.29	80.00 ± 9.42
Degree	2	26.50 ± 3.54	24.5 ± 0.71	14.00 ± 1.41	15.50 ± 0.71	80.50 ± 2.12
ANOVA		f = 0.12 p = 0.891	f = 0.27 p = 0.763	f = 0.93 p = 0.397	f = 0.10 p = 0.902	f = 0.05 p = 0.948
Academic year						
Year 1	122	25.96 ± 3.32	23.21 ± 3.67	15.94 ± 2.38	15.95 ± 2.37	81.07 ± 9.48
Year 2	110	25.5 ± 2.79	22.72 ± 3.95	15.90 ± 2.35	16.35 ± 2.33	80.47 ± 9.26
t-test		t = 1.13 p = 0.258	t = 0.99 p = 0.324	t = 0.14 p = 0.891	t = -1.31 p = 0.193	t = 0.481 p = 0.631

Notes: LM = Learning motivation, PI = Planning and implementing, SM = Self-monitoring, IC = Interpersonal communication

Open-Ended Questionnaire

Of 232 respondents, only two (0.85%) failed to answer all three open-ended questions. For each individual question, around 10 to 15 respondents opted not to answer at least one of the questions. Three themes emerged from Question 1, and five themes emerged from each of Question 2 and Question 3. Sample statements about the themes in each question are listed in Table 3.

Table 3: Sample statements for the major themes of the open-ended questions

Question 1: What do you understand about SDL?	
Themes	Sample statements
Self-learning	“Students can learn by [using] their own study techniques with some guidance from the lecturers”. “I learn by myself using my own materials”.
Special session	“It is the slot allocated for the students to study on their own, at their own pace”. “It is the time that can be used by students to review their lectures and learning materials”.
Learning method	“A learning method to improve ourselves”.

(Continued on next page)

Table 3: (Continued)

Question 2: What is/are the important promoting factor(s) to ensure the effectiveness of SDL?	
Themes	Sample statements
Guidance, resources and monitoring	<p>“Have someone to guide such as a lecturer that students can contact easily whenever they find something they don’t understand”.</p> <p>“An organised resource e.g. a website or lecture notes, that students can read by themselves and know what they should be focusing on. Personally, reading a textbook sometimes can be very overwhelming as it is flooded with information and [I] ended up not understanding anything”.</p>
Motivational factors	<p>“I think constant encouragement from lecturers is important”.</p> <p>“Motivation from friends and students themselves are very helpful in order to understand all the learning outcomes”.</p>
Learning environment	<p>“The environment needs a good Wi-Fi connection, with less distractions and good access to resources for references or to ask questions”.</p>
Self-discipline	<p>“I believe that discipline and self-awareness are important to ensure the effectiveness of SDL. This is because each student has different study techniques and levels of understanding and memorisation. Therefore, each student must be aware that they have their own goals and their own pace of learning. Discipline is important to ensure the students follow their study planner and reach their goals”.</p>
Curriculum	<p>“Less assignments, less disruption, [and more] calmness ensures the effectiveness of SDL”.</p>
Question 3: What challenge(s) might deter the effectiveness of SDL?	
Themes	Sample statements
Guidance, resources and monitoring	<p>“The challenge of SDL is inadequate strategies due to [a] lack of guidelines on its complementation. Students may find it hard to find their own way of studying while also ensuring they are on the right track of studying”.</p> <p>“Lack of resources due to inexperience in where to find them”.</p>
Motivational factors	<p>“Students lose interest in SDL when they keep failing tests”.</p> <p>“Sometimes I don’t have the motivation to study on my own especially when I’m at home, considering that I don’t see anyone struggling the same as me”.</p>
Learning environment	<p>“Interruption at home like family members [calling] for help”.</p> <p>“Distractions in the form of gadgets can cause our SDL to be less effective as we spend SDL [time] playing [with] our phones or watching movies”.</p>
Self-discipline	<p>“Procrastination. It is the root of failure. The work will pile up causing the students to do work at the very last minute. Hence, this will take away the joy of SDL and they will think it is a burden”.</p> <p>“No self-discipline and poor time management”.</p>
Curriculum	<p>“Information overload. There is too much information to read”.</p> <p>“When the schedule is too packed”.</p>

DISCUSSION

Interestingly, the mean total SDLI score in this study was higher than those reported among medical students in China (4) and nursing students in China (21). Higher SDL abilities among these students might be associated with the environment that they had experienced for these past two years due to the COVID-19 pandemic, these students generally undertook online, open and distance learning (ODL) at home which required considerable independence (28, 29). These cohorts of students, despite being new to university life, had to adapt to the pandemic-induced changes. Compared to their seniors, they did not have the opportunity to stay in residential colleges on campus where students can focus solely on their studies.

Being at home during the pandemic also limited the peer-to-peer interaction that is important in improving learning motivation and environment (30). The challenges that have been associated with online learning at home during the pandemic include poor internet connection, a lack of appropriate devices, poor learning space, poor time management and more distractions (31). Despite these challenges, several reports have shown that the COVID-19 pandemic has cultivated more independent learning among students (32, 33), which could explain the higher SDLI score obtained in this study. Students might have presumed they have better SDL abilities while engaged in open or distance learning because they must find most learning resources by themselves because they cannot access the faculty, where numerous resources are readily available.

The majority of the respondents understood SDL to be a self-learning process with or without help from others. The variation in their understanding of self-learning was quite substantial. At one extreme, some respondents understood SDL to be the learning that was done only by the student alone, with no help from others. Some sample statements reflecting this are: "I need to settle the problems/questions by myself without the help from the professional (e.g. lecturers) and I need to do further reading about the case by myself", and "It is about learning everything by myself and trying to find my own resources". The association of SDL with learning alone without help from others was also evident in other studies (34). However, most respondents in the current study seemed to understand the basic concept of SDL since they covered how, when and what to learn, even though no respondents linked it specifically to the concept of adult learning.

Most respondents preferred some sort of guidance or reliable resources to help them pursue SDL. Premkumar et al. (12) reported similar findings, whereby students, especially for those who are new to the medical programme, wanted clear guidance on what needed to be learnt during their self-study. Students claimed to be lost due to the ocean of knowledge available in textbooks and on the internet, so, guides from lecturers were essential to ensure the appropriate knowledge was being learnt (14). The faculty should create a proper guide containing clear learning outcomes, suggested reading materials from books and online websites as well as a brief explanation of what SDL is.

Around 20% of the respondents claimed that having a good, conducive learning environment promotes SDL. This cohort of respondents experienced a long period of ODL at home due to the COVID-19 pandemic; when this survey was conducted, they had returned to campus and were staying in a residential college nearby. Compared to the home setting, where not everyone has the privilege of enjoying a proper learning environment, these students appreciated more how the learning environment could promote their initiative to learn. On campus, learning resources are easily available and accessible to everyone. Several studies have shown how the COVID-19 pandemic affected students' learning because of a lack of a proper learning environment at home (31, 35).

The respondents claimed that having a lower academic workload would promote SDL as they wanted more time to learn on their own. Packed schedules especially those with didactic lectures, seem to deter SDL among students (14). Didactic lectures are considered to be teacher-centred activities in which students felt they had little participation. In contrast, teaching-learning activities that promote collaboration and feedback between the students themselves and between teachers and students have been shown to promote SDL (36).

Motivation plays a major role in promoting SDL (24), as seen in this study. In the SDL model described by Garrison (24), the two components of motivation are self-monitoring and self-management. The former process includes critical thinking, reflection and external

feedback so that the students are compelled to learn and improve themselves. The latter process includes setting learning goals, the appropriate use of resources and having external support that ensures students are on the right track to achieve their goals. Other than motivational support, students themselves need firm self-discipline to regulate their self-learning (37). However, the two factors of motivation and discipline are interrelated. The absence of self-discipline usually is associated with a lack of motivation to learn (38).

Additionally, difficult topics, students having to read too much information, and packed schedules seemed to be the challenges in implementing SDL reported in this study. Compared to other degree programmes, medical programmes are known to have more packed schedules (39). Preclinical year students might feel overwhelmed and burnt out by this, reducing their motivation to learn more by themselves (40). A special exploration of the curriculum design should be undertaken by the faculty to prevent a lack of motivation among the students. The burnout and chronic stress among medical students might also explain why SDL abilities deteriorate in the later academic years, which Premkumar and colleagues (12, 17) identified.

CONCLUSION

This study showed that preclinical medical students have good SDL abilities. This may be due to their prolonged exposure to ODL, which required them to become more independent. Guide and support from lecturers and the faculty are important influencing factors of SDL among these students. These factors also influence the students' motivation to learn. Students should enforce self-discipline on themselves to improve their self-management, which are essential for attaining their academic goals.

ETHICAL APPROVAL

This study was approved by the ethical committees of Universiti Malaya (UM.TNC2/UMREC_1957) and Universiti Teknologi MARA REC/07/2022 (ST/MR/145).

REFERENCES

1. Knowles MS. *Self-directed learning: a guide for learners and teachers*. NY: Association Press; 1975.
2. Lee H, Mori C. Reflective practices and self-directed learning competencies in second language university classes. *Asia Pacific J Educ*. 2021;41(1):130–51. <https://doi.org/10.1080/02188791.2020.1772196>
3. Murad MH, Coto-Yglesias F, Varkey P, Prokop LJ, Murad AL. The effectiveness of self-directed learning in health professions education: a systematic review. *Med Educ*. 2010;44(11):1057–68. <https://doi.org/10.1111/j.1365-2923.2010.03750.x>
4. Yang C, Zhu Y, Jiang H, Qu B. Influencing factors of self-directed learning abilities of medical students of mainland China: a cross-sectional study. *BMJ Open*. 2021;11(10):e051590. <https://doi.org/10.1136/bmjopen-2021-051590>

5. Alotaibi KN. The learning environment as a mediating variable between self-directed learning readiness and academic performance of a sample of Saudi nursing and medical emergency students. *Nurse Educ Today*. 2016;36:249–54. <https://doi.org/10.1016/j.nedt.2015.11.003>
6. Rashid T, Asghar HM. Technology use, self-directed learning, student engagement and academic performance: examining the interrelations. *Comput Hum Behav*. 2016;63:604–12. <https://doi.org/10.1016/j.chb.2016.05.084>
7. Durnali M. The effect of self-directed learning on the relationship between self-leadership and online learning among university students in Turkey. *Tuning J High Educ*. 2020;8(1):129–65. [https://doi.org/10.18543/tjhe-8\(1\)-2020pp129-165](https://doi.org/10.18543/tjhe-8(1)-2020pp129-165)
8. Song Y, Yun SY, Kim SA, Ahn EK, Jung MS. Role of self-directed learning in communication competence and self-efficacy. *J Nurs Educ*. 2015;54(10):559–64. <https://doi.org/10.3928/01484834-20150916-03>
9. Neimeyer GJ, Taylor JM, Cox DR. On hope and possibility: does continuing professional development contribute to ongoing professional competence? *Prof Psychol Res Pr*. 2012;43(5):476–86. <https://doi.org/10.1037/a0029613>
10. Ricotta DN, Richards JB, Atkins KM, Hayes MM, McOwen K, Soffler MI, et al. Self-directed learning in medical education: training for a lifetime of discovery. *Teach Learn Med*. 2022;34(5):530–40. <https://doi.org/10.1080/10401334.2021.1938074>
11. Anshu, Gupta P, Singh, T. The concept of self-directed learning: implications for practice in the undergraduate curriculum. *Indian Pediatr*. 2022;59:331–8. <https://doi.org/10.1007/s13312-022-2501-x>
12. Premkumar K, Pahwa P, Banerjee A, Baptiste K, Bhatt H, Lim HJ. Does medical training promote or deter self-directed learning? A longitudinal mixed-methods study. *Acad Med*. 2013;88(11):1754–64. <https://doi.org/10.1097/ACM.0b013e3182a9262d>
13. AlRadini F, Ahmad N, Kahloon LE, Javid A, Al Zamil N. Measuring readiness for self-directed learning in medical undergraduates. *Adv Med Educ Pract*. 2022;13:449–55. <https://doi.org/10.2147/AMEP.S360333>
14. Kidane HH, Roebertsen H, Van der Vleuten CP. Students' perceptions towards self-directed learning in Ethiopian medical schools with new innovative curriculum: a mixed-method study. *BMC Med Educ*. 2020;20(1):1–10. <https://doi.org/10.1186/s12909-019-1924-0>
15. Balamurugan S, Kumar H. Self-directed learning readiness (SDLR) among medical students: a questionnaire-based study from an Indian medical school. *South-East Asian J Med Educ*. 2015;9(2):59–64. <https://doi.org/10.4038/seajme.v9i2.86>
16. McGrath D, Crowley L, Rao S, Toomey M, Hannigan A, Murphy L, et al. Outcomes of Irish graduate entry medical student engagement with self-directed learning of clinical skills. *BMC Med Educ*. 2015;15(1):1–7. <https://doi.org/10.1186/s12909-015-0301-x>
17. Premkumar K, Vinod E, Sathishkumar S, Pulimood AB, Umaefulam V, Prasanna Samuel P, et al. Self-directed learning readiness of Indian medical students: a mixed method study. *BMC Med Educ*. 2018;18(1):1–10. <https://doi.org/10.1186/s12909-018-1244-9>
18. Tekkol İ A, Demirel M. An investigation of self-directed learning skills of undergraduate students. *Front Psychol*. 2018;9:2324. <https://doi.org/10.3389/fpsyg.2018.02324>
19. Leatemala LD, Susilo AP, van Berkel H. Self-directed learning readiness of Asian students: students perspective on a hybrid problem based learning curriculum. *Int J Med Educ*. 2016;7:385–92. <https://doi.org/10.5116/ijme.582e.021b>

20. Slater CE, Cusick A, Louie JC. Explaining variance in self-directed learning readiness of first year students in health professional programs. *BMC Med Educ.* 2017;17(1):207. <https://doi.org/10.1186/s12909-017-1043-8>
21. Shen WQ, Chen HL, Hu Y. The validity and reliability of the self-directed learning instrument (SDLI) in mainland Chinese nursing students. *BMC Med Educ.* 2014;14(1):1–7. <https://doi.org/10.1186/1472-6920-14-108>
22. Kemp K, Baxa D, Cortes C. Exploration of a collaborative self-directed learning model in medical education. *Med Sci Educ.* 2022;32(1):195–207. <https://doi.org/10.1007/s40670-021-01493-7>
23. Cadorin L, Suter N, Dante A, Williamson SN, Devetti A, Palese A. Self-directed learning competence assessment within different healthcare professionals and amongst students in Italy. *Nurse Educ Pract.* 2012;12(3):153–8. <https://doi.org/10.1016/j.nepr.2011.10.013>
24. Garrison DR. Self-directed learning: toward a comprehensive model. *Adult Educ Q.* 1997;48(1):18–33. <https://doi.org/10.1177/074171369704800103>
25. Brockett RG. The relationship between self-directed learning readiness and life satisfaction among older adults. *Adult Educ Q.* 1985;35(4):210–9. <https://doi.org/10.1177/0001848185035004003>
26. Nurul-Awanis AW, Hazlina AH, Yoke-May L, Zariyawati MA. Malaysian education system reform: educationists' perspectives. In: *Proceedings of the International Conference on Social Science, Economics and Art*; 2011 January 14–15; Hotel Equatorial Bangi-Putrajaya, Malaysia; p.107–11.
27. Cheng SF, Kuo CL, Lin KC, Lee-Hsieh J. Development and preliminary testing of a self-rating instrument to measure self-directed learning ability of nursing students. *Int J Nurs Stud.* 2010;47(9):1152–8. <https://doi.org/10.1016/j.ijnurstu.2010.02.002>
28. Wege K, Harso A, Wolo D. Analysis of student learning independence during the pandemic. *J Res Instr.* 2022;2(1):87–96. <https://doi.org/10.30862/jri.v2i1.34>
29. Dumiyati D, Aeni C. E-learning management to improve student learning independence in the COVID-19 pandemic era. *Vidya Karya.* 2021;36(2):75–83. <https://doi.org/10.20527/jvk.v36i2.10695>
30. Liu CY, Chen HL. Effects of peer learning on learning performance, motivation, and attitude. *Int J Educ Econ Dev.* 2020;11(4):420–43. <https://doi.org/10.1504/IJEED.2020.110599>
31. Barrot JS, Llenares II, Del Rosario LS. Students' online learning challenges during the pandemic and how they cope with them: the case of the Philippines. *Educ Inf Technol.* 2021;26(6):7321–38. <https://doi.org/10.1007/s10639-021-10589-x>
32. Yan L, Whitelock-Wainwright A, Guan Q, Wen G, Gašević D, Chen G. Students' experience of online learning during the COVID-19 pandemic: a province-wide survey study. *Br J Educ Technol.* 2021;52(5):2038–57. <https://doi.org/10.1111/bjet.13102>
33. Ghazali FA. Challenges and opportunities of fostering learner autonomy and self-access learning during the COVID-19 pandemic. *SiSAL.* 2020;11(3):114–27. <https://doi.org/10.37237/110302>
34. Hewitt-Taylor J. Self-directed learning: views of teachers and students. *J Adv Nurs.* 2001;36(4):496–504. <https://doi.org/10.1046/j.1365-2648.2001.02001.x>
35. Amir LR, Tanti I, Maharani DA, Wimardhani YS, Julia V, Sulijaya B, et al. Student perspective of classroom and distance learning during COVID-19 pandemic in the undergraduate dental study program Universitas Indonesia. *BMC Med Educ.* 2020;20(1):1–8. <https://doi.org/10.1186/s12909-020-02312-0>

36. Brockett RG, Hiemstra R. Self-direction in adult learning: perspectives on theory, research, and practice. New York: Routledge; 2018. <https://doi.org/10.4324/9780429457319>
37. du Toit-Brits C, van Zyl CM. Self-directed learning characteristics: making learning personal, empowering and successful. *Africa Educ Rev.* 2017;14(3-4):122-41. <https://doi.org/10.1080/18146627.2016.1267576>
38. Garrison DR. Critical thinking and self-directed learning in adult education: an analysis of responsibility and control issues. *Adult Educ Q.* 1992;42(3):136-48. <https://doi.org/10.1177/074171369204200302>
39. Crump WJ, Steve Fricker R, Ziegler CH. Outcomes of a preclinical rural medicine elective at an urban medical school. *Fam Med.* 2010;42(10):717-22.
40. Cecil J, McHale C, Hart J, Laidlaw A. Behaviour and burnout in medical students. *Med Educ Online.* 2014;19(1):25209. <https://doi.org/10.3402/meo.v19.25209>