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MEDICAL STUDENTS' LEARNING APPROACH: FACTORS INFLUENCING SELF DIRECTED LEARNING

Dr. Firdous Jahan*[1], Dr. Muhammad A. Siddiqui[2], Maryann Radiance Aguiar[1], Muzna Said Rashid AL Asmi[1]

[1]Family Medicine Department College of Medicine and Health Sciences National University Science and Technology, Sohar, Oman.
[2]Department of Research Saskatchewan Health Authority Regina, Canada.

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***Corresponding author: Dr. Firdous Jahan**

Family Medicine Department College of Medicine and Health Sciences National University Science and Technology, Sohar, Oman.

ABSTRACT

Medical education is now student centered and medical students are responsible for their own leaning choice and in depth learning. The ability for physicians to think critically is the key in reducing medical errors. There is a need to change the strategy to give them the opportunity to become a self-directed learning (SDL) and lifelong learner. The learning attitude of student identifying their learning needs. The aim of the study was to explore medical students' learning approach and factors influencing self-directed and in depth learning. A cross sectional study was conducted at College of Medicine and Health Sciences, National University Science and Technology, Sohar Oman. A convenient sample size was obtained from pre medical, pre-clinical and clinical students consented to participate was included in the study. Data collection was carried out using a structured self-administered questionnaire. Statistical analysis was performed using SPSS (IBM SPSS Statistics 24.0). A total of 362 medical students were participated in the study of which 119 (32.9%) were pre medical students, 131 (36.2%) were pre-clinical students and 112 (30.9%) were clinical students. Among all participants, 97 (26.8%) were male and nearly one quarter of participants (24.6%) were Non-Omani. Statistically significant difference ($p<0.001$) was observed between groups regarding schooling background, health issues, aging process and time management. Similarly, significant difference was observed between groups regarding learning style (PBL, lectures, small group), curriculum overload, assessment method and Formative assessment (Mock theory, mock OSCE, quiz). This study highlights the importance of self-directed learning and self-regulation in the context of preferred learning style. The influences of external and internal factors on learning strategies and self-efficacy are important aspects to consider when designing a curriculum

KEYWORDS: Self-directed learning, medical student, learning, factors influencing SDL, learning style.

INTRODUCTION

In modern medical education, teaching and learning is now student centered. Medical students are responsible for their own learning choice and in depth learning.[1,2] There is a need to change the strategy to give them the opportunity to become a self-directed and lifelong learner. The learning attitude of student identifying their learning needs, self-regulation formulating goals, and evaluating learning outcomes are the main objectives of medical education.[3,4] Effective and conducive learning environment facilitates in depth learning and critical thinking process where students express their opinion, with maximum hands on practice (doing).

Students' focused teaching with meaning full interaction improves self-confidence and self-control in learner. Understanding how someone learn can help to target training and teaching strategy.[5] The Kolb learning style inventory recognizes individual learning preferences, while encouraging individuals to expand their learning strengths.[6] The development of critical thinking skills and in depth learning in medical student is important to improve patient care. A critical thinking skill emphasizes cognitive strategies, focuses on the internal motivation for problem solving.[7,8] Bloom's hierarchical approach to educational objectives serves as the framework for developing critical thinking skills from the perspective of course assessment. Assessment tools, developed for evaluation of individual performance within the course, are based on this order Miller (1990) developed a pyramid as a framework of levels of performance in clinical assessment. In increasing importance, these

levels are: knowledge, competence, performance, and action.[9,10]

Self-regulation of motivation involves controlling motivational beliefs such as self-efficacy, goal orientation. In patient care, learners are to compassionate, appropriate, and effective for the treatment of health problems and the promotion of health.[11] College of Medicine and Health Sciences (CMHS) is committed to preparing high quality health professionals who are dedicated to meeting the present and future health care needs of the people of Oman and beyond. The graduates' attributes include professionalism, appropriate communication skill, in depth knowledge and skills in patient care to improve the health outcome. The learning outcome of our graduate also includes critical thinking and clinical reasoning which comes through deep learning and intrinsic motivation. These six domains of competencies are patient care, medical knowledge, professionalism, interpersonal and communication skills, systems-based practice, and practice-based learning and improvement. Critical thinking is a skill that is necessary in bridging all six domains because it requires knowledge of disease, interpersonal skills and communication, navigation through the medical system, and self-regulation for professional growth. This research explores the factors influencing in-depth and self-directed learning in medical students.

MATERIALS AND METHODS

A cross sectional study was conducted at College of Medicine and Health Sciences, National University Science and Technology, Sohar Oman. A convenient sample size was obtained from pre medical, pre-clinical and clinical students consented to participate was included in the study. Data collection was carried out using a structured self-administered questionnaire, especially designed for this study. Survey instrument was made after literature search reviewed by and agreed on via several brain storming sessions and understanding, so the questionnaire would maximize the response rates.

The proposal and questionnaire was prepared and approved with institutional ethical review committee. All medical students were invited to participate. Participants were enrolled after taking written informed consent. The principal investigator ensured uniformity and two trained research assistants assisted principal investigator in data collection. A questionnaire was designed comprising of 3 components; the first section consists of demographic details of the participants. Section two was containing questions about factors influencing deep and self-directed learning (personal /curriculum) and finally third section was about the preferred style of learning.

Preferred style of learning

- Divergent: Concrete experience and reflective observation
- Assimilative: Abstract conceptualization and reflective observation
- Convergent: Abstract conceptualization and active experimentation
- Accommodative: Concrete experience and active experimentation

Statistical analysis was performed using SPSS (IBM SPSS Statistics 24.0). Data was expressed in frequencies for questionnaire responses calculated for all variables in numbers and percentages. Independent sample t-test was used to compare differences between two groups with parametric data and one-way analysis of variance (ANOVA) test was used to compare differences between three groups with parametric continuous data. If a significant difference ($p < 0.05$) was found between groups, and the differences were revealed using the Tukey HSD post hoc test.

RESULTS

A total of 362 medical students were participated in the study in which 119 (32.9%) were pre medical students, 131 (36.2%) were pre-clinical students and 112 (30.9%) were clinical students. Among all participants, 97 (26.8%) were male and 265 (73.2%) were female students. Nearly one quarter of participants (24.6%) were Non-Omani and rests were Omani citizens (75.4%).

Participants were asked multiple questions about personal factors influencing deep learning and self-directed learning, their responses were in the scale of 1 to 5 (1 strongly agree and 5 is strongly disagree). There was a statistically significant difference was observed between groups regarding schooling background, health issues, aging process and time management as determined by one-way ANOVA (Table 1).

Table 1: Personal Factors Influencing Deep learning and Self-directed learning.

	Pre medical students	Pre-clinical students	Clinical students	Sig.
Schooling back ground	1.92 (0.92)	2.08 (0.78)	2.31 (1.07)	0.005
Parental involvement	2.29 (0.96)	2.10 (0.98)	2.39 (1.10)	0.07
Culture and Life style	2.31 (0.89)	2.11 (0.78)	2.3 (1.01)	0.13
Balance between personal and professional life	1.76 (0.85)	1.73 (0.81)	1.88 (0.92)	0.38
Integration of knowledge and memory	1.88 (0.83)	1.66 (0.77)	1.68 (0.97)	0.08
Language barrier	2.04 (0.81)	2.29 (1.06)	2.23 (1.15)	0.14
Intrinsic motivation/interest in learning	1.59 (0.74)	1.49 (0.69)	1.7 (1.05)	0.15

Health issues	2.5 (1.12)	1.9 (0.86)	2.04 (1.03)	<0.001
Aging process	2.97 (1.01)	2.8 (0.98)	2.61 (1.13)	0.03
Hands on practice	1.89 (0.84)	1.67 (0.83)	1.68 (0.9)	0.08
Stress in life/ managing challenges	1.86 (0.81)	1.66 (0.83)	1.79 (0.94)	0.17
Time management	1.42 (0.71)	1.48 (0.70)	1.69 (1.02)	0.03
Self confidence	1.8 (0.79)	1.66 (0.73)	1.8 (1.01)	0.34
Peer group/ mentoring	2.34 (0.81)	2.21 (0.88)	2.06 (1.01)	0.06
Creative and critical thinking	1.91 (0.85)	1.89 (0.84)	1.95 (1.03)	0.87
Social media	2.45 (0.95)	2.4 (0.93)	2.35 (1.14)	0.76

In Table 2 Tukey post-hoc analysis revealed that response regarding schooling background was statistically significantly different between 2nd & 3rd year student and 6th & 7th year ($p = 0.004$). Response regarding health issues was statistically significant different between 2nd & 3rd year and 4th & 5th year students ($p < 0.001$). Similarly, significant difference was observed between 2nd & 3rd year student and 6th & 7th year ($p = 0.002$). Responses of 2nd & 3rd year and 6th & 7th year students were different regarding aging process ($p=0.05$) and time management ($p=0.036$).

Table 2: Tukey post-hoc analysis among significant personal factors.

	Group	Group	Mean Difference	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Schooling back ground	2nd & 3rd Year	4th & 5th Year	-.168	.325	-.44	.11
	2nd & 3rd Year	6th & 7th Year	-.397*	.004	-.68	-.11
	4th & 5th Year	6th & 7th Year	-.229	.135	-.51	.05
Health issues	2nd & 3rd Year	4th & 5th Year	.595*	.000	.30	.89
	2nd & 3rd Year	6th & 7th Year	.460*	.002	.15	.77
	4th & 5th Year	6th & 7th Year	-.135	.549	-.44	.17
Aging process	2nd & 3rd Year	4th & 5th Year	.173	.388	-.14	.48
	2nd & 3rd Year	6th & 7th Year	.368*	.021	.05	.69
	4th & 5th Year	6th & 7th Year	.194	.315	-.12	.51
Time management	2nd & 3rd Year	4th & 5th Year	-.061	.827	-.30	.18
	2nd & 3rd Year	6th & 7th Year	-.267*	.036	-.52	-.01
	4th & 5th Year	6th & 7th Year	-.207	.123	-.45	.04

In the questionnaire, participants were asked regarding curriculum factors influencing deep learning and self-directed learning. There was a statistically significant difference was observed between groups regarding learning style (PBL, lectures, small group), curriculum overload, assessment method and Formative assessment (Mock theory, mock OSCE, quiz) as determined by one-way ANOVA (Table 3).

Table 3: Curriculum Factors Influencing Deep learning and Self-directed learning.

	Pre medical students	Pre-clinical students	Clinical students	Sig.
Learning style: PBL, Lectures, small group	2.08 (0.83)	2.37 (1.04)	2.11 (0.99)	0.03
Curriculum overload	2.55 (1.01)	2.16 (1.04)	2.26 (1.14)	0.01
Curriculum set up: Sequences of courses	2.21 (0.87)	2.12 (0.76)	2.15 (1.08)	0.74
Feedback/self-assessment	2.03 (0.86)	2.19 (0.82)	2.08 (0.96)	0.35
Assessment method	2.13 (0.86)	2.43 (0.92)	2.17 (0.99)	0.02
Formative assessment (Mock theory, mock OSCE, quiz)	2.22 (0.88)	2.3 (0.99)	1.96 (0.99)	0.02
Learning environment	1.76 (0.73)	1.91 (0.96)	1.81 (1.03)	0.458
Student focused approach	2.0 (0.77)	1.93 (0.79)	1.89 (0.98)	0.62
Clinical scenario based teaching	1.9 (0.79)	1.92 (0.90)	1.96 (1.01)	0.85
Health wellbeing program	2.18 (0.78)	2.06 (0.78)	2.05 (0.98)	0.46
Teacher student interaction	2.02 (0.91)	2.05 (0.91)	2.01 (1.09)	0.95
Full time teacher	2.55 (0.92)	2.54 (0.95)	2.31 (1.07)	0.11
Role models	2.29 (0.76)	2.27 (0.86)	2.24 (0.99)	0.89
Teachers training/workshop	2.13 (0.80)	2.02 (0.89)	2.06 (0.92)	0.59

In Table 4, pairwise comparisons of the means using Tukey's post-hoc analysis indicated response regarding learning style: PBL, lectures, small group was statistically significantly different between 2nd & 3rd year and 6th & 7th year students (p = 0.04). Similarly, responses of 2nd & 3rd year and 6th & 7th year students were different regarding curriculum overload (p=0.012) and assessment method (p=0.034). Response regarding Formative assessment (Mock theory, mock OSCE, quiz) was statistically significant different between 4th & 5th year and 6th & 7th year students (p <0.016).

Table 4: Tukey post-hoc analysis among significant curriculum factors.

	Group	Group	Mean Difference	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Learning style: PBL, Lectures, small group	2nd & 3rd Year	4th & 5th Year	-.298*	.040	-.59	-.01
	2nd & 3rd Year	6th & 7th Year	-.032	.967	-.33	.27
	4th & 5th Year	6th & 7th Year	.267	.081	-.03	.56
Curriculum overload	2nd & 3rd Year	4th & 5th Year	.386*	.012	.07	.70
	2nd & 3rd Year	6th & 7th Year	.287	.102	-.04	.62
	4th & 5th Year	6th & 7th Year	-.099	.752	-.42	.22
Assessment method	2nd & 3rd Year	4th & 5th Year	-.293*	.034	-.57	-.02
	2nd & 3rd Year	6th & 7th Year	-.035	.955	-.32	.25
	4th & 5th Year	6th & 7th Year	.258	.079	-.02	.54
Formative assessment (Mock theory, mock OSCE, quiz)	2nd & 3rd Year	4th & 5th Year	-.079	.791	-.37	.21
	2nd & 3rd Year	6th & 7th Year	.263	.095	-.03	.56
	4th & 5th Year	6th & 7th Year	.342*	.016	.05	.63

Participants were asked about their experience and reflective observation; their responses were recorded in yes or no (Figure 1). No significant relationship was observed between students group and their responses regarding combination of concrete experience and reflective observation X^2 (Sig) = 7.5 (0.27) and feeling and watching X^2 (Sig) = 7.4 (0.11).

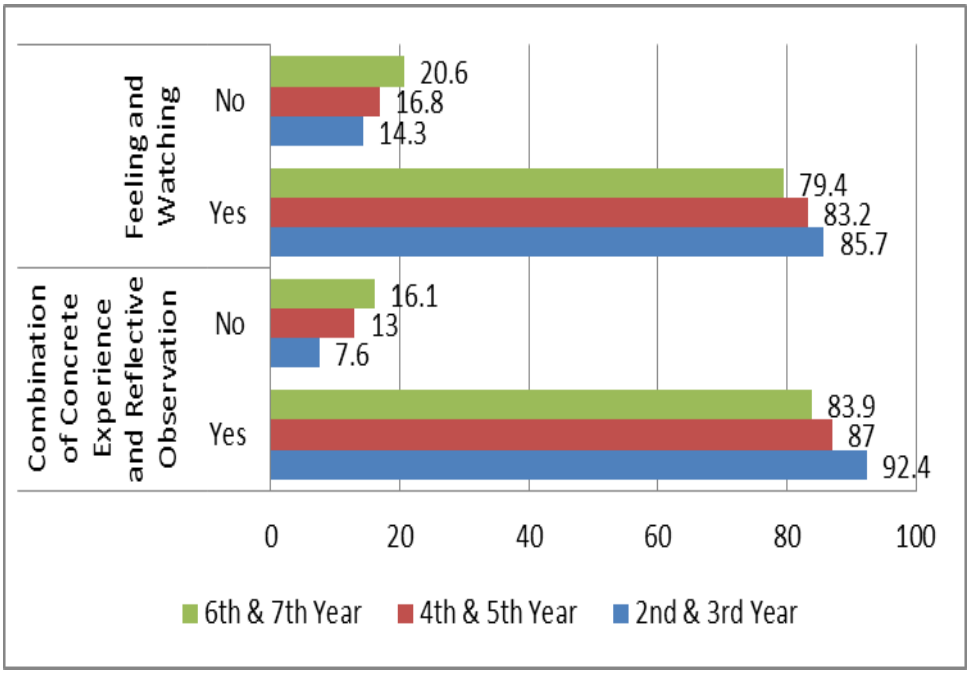

Figure 1: Concrete experience and reflective observation.

Students were asked about abstract conceptualization and reflective observation; their responses were recorded in yes or no (Figure 2). A significant relationship was observed between 3 different students groups and their responses regarding combination of abstract conceptualization and reflective observation X^2 (Sig) = 16.4 (0.002) and watching and thinking X^2 (Sig) = 15.4 (0.01).

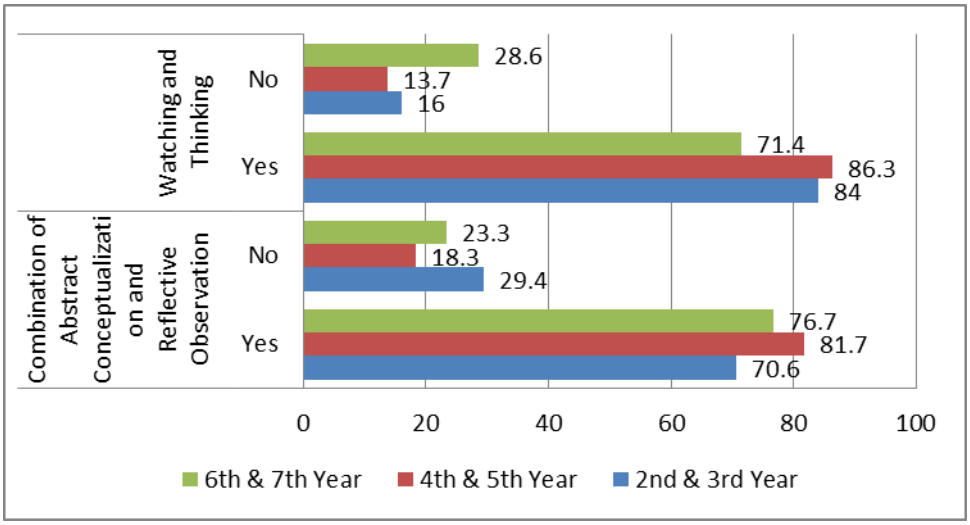

Figure 2: Assimilative: Abstract conceptualization and reflective observation.

In the study questionnaire, students were asked about abstract conceptualization and active experimentation; their responses were recorded in yes or no (Figure 3). No association was observed between different student group's responses and doing and thinking X^2 (Sig) = 4.5 (0.34). However, a significant relationship was observed between 3 different student groups and their responses regarding combination of abstract conceptualization and active experimentation X^2 (Sig) = 6.89 (0.032)and solve practical problems; prefer technical tasks, like experimenting and simulation, less interested in interpersonal issues X^2 (Sig) = 12.8 (0.01).

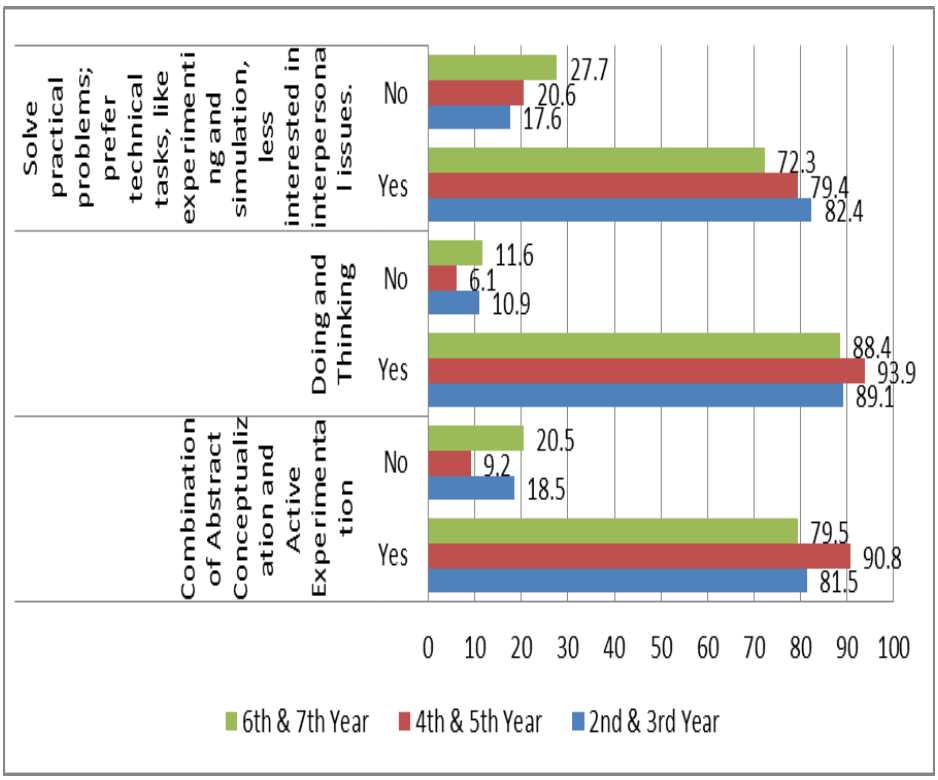

Figure 3: Convergent: Abstract conceptualization and active experimentation.

Study participants were asked about their concrete experience and active experimentation; their responses were recorded in yes or no (Figure 4). No significant relationship was observed between students group and their responses regarding combination of concrete experience and active experimentation X^2 (Sig) = 6.2 (0.18). Conversely, a significant relationship was observed between 3 different student groups and their responses regarding doing and feeling X^2 (Sig) = 9.6 (0.04) and hands on, attracted to new challenges and experiences, rely on others instead of doing own analysis, action oriented, set targets work hard in teams to achieve tasks X^2 (Sig) = 18.4 (0.005).

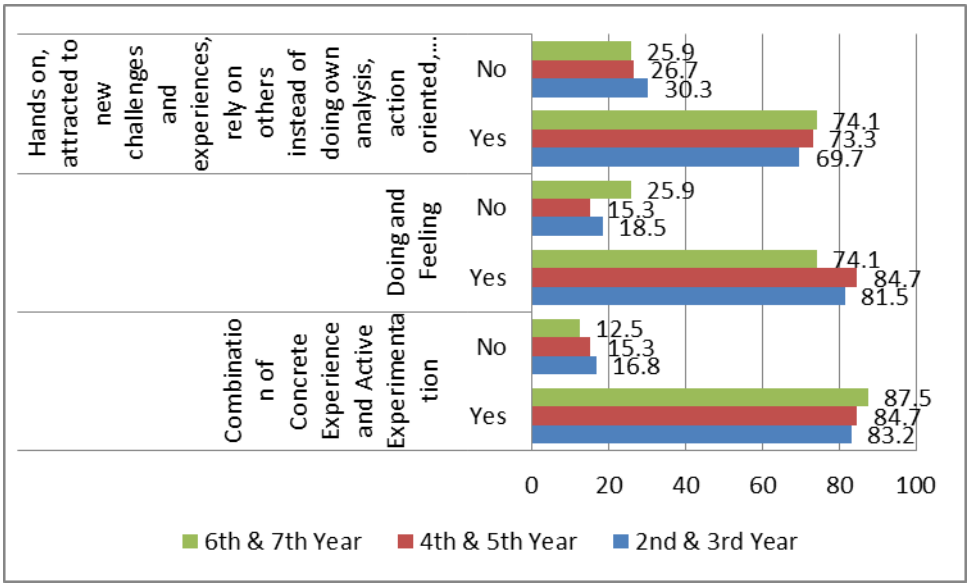

Figure 4: Accommodative: Concrete experience and active experimentation.

Table 5: Preferred learning Style.

	Pre medical n (%)	Pre-clinical n (%)	Clinical n (%)
Divergent:	110 (92.4)	114(84)	95(84.8)
Assimilative:	84(70.6)	107(81.7)	89(79.5)
Convergent:	97(81.5)	119(90.8)	89(79.5)
Accommodative:	99(83.2)	111(84.7)	85(75.9)

DISCUSSION

Medical education and teaching and learning are evolving constantly. Learning style is the process by which a learner learns and retains information, gaining in depth knowledge or skills based on the conceptual learning.[12] The learning cycle and reflective practice is to make many small improvements. SDL has been shown to elevate the student's confidence and facilitate independence in learning in dynamic and challenging educational and work environments. The ability to modify one's behavior depends on how well we combine our experiences, reflection, conceptualization, and planning to make improvements.[13]

The factors affecting the learning style and SDL that were identified in this study included family, peers, instructors, educational environment, and personal characteristics of students. Recognizing an individual's strengths and preferred learning style will allow the tailoring of the learning experience and critical thinking which ultimately increases the efficiency with obvious positive effects on time, utilization, and outcome.[14]

In our study participants were asked about personal factors influencing deep learning and self-directed learning response regarding schooling background, health issues, hands on practice, time management and peer assisted learning was statistically significant (Table 1-2). Literature has shown the same result and one of the most important focuses for instructors in educational institutions is to understand the factors that lead to better success and sound clinical outcome.[15,16] SDL is extremely important in clinical teaching and learning as most of the learning is opportunistic and learner needs to know the self-efficacy as well as deficiency. As reported in the literature, the relationship among belongingness, self-esteem, and self-directed learning based on the conceptual framework.[17,18]

In this study significant difference was observed curriculum factors influencing deep learning and self-directed learning between groups regarding learning style (PBL, lectures, small group), curriculum overload, assessment method and Formative assessment (Mock theory, mock OSCE, quiz) (Table 3-4). Martin P et al reported that the use of self-directed learning initiatives has been shown to promote increased student participation in clerkships. These concepts focus on how to stimulate students' intrinsic pedagogical and cognitive capacities for teaching and learning clinical skills.[19,20,21]

Students were asked about abstract conceptualization and reflective observation (Figure1- 2). A significant relationship was observed between 3 different students groups and their responses regarding combination of abstract conceptualization and reflective observation and watching and thinking. Effective teaching and learning can be done by identifying personal preferred learning style and these activities can be modified in future undergraduate medical education (Table 5).

In this study, a significant relationship was observed between 3 different student groups and their responses

regarding combination of abstract conceptualization and active experimentation and solves practical problems; prefer technical tasks, like experimenting and simulation, less interested in interpersonal issues.[22,23] Researchers have mentioned that undergraduate medical students' self-regulated learning requires context-specific support.[24,25]

The outcomes of student understanding of the factors affecting self-regulation indicate that facilitating factors should be used on an individual basis to reduce the effect of inhibiting factors to improve self-regulation in students**.** Factors influencing in depth learning such as the large volume of contents, lack of relationship between contents and future career lack of self-efficacy, and stress.[26]

A significant relationship was observed between 3 different student groups and their responses regarding doing and feeling and hands on, attracted to new challenges and experiences, rely on others instead of doing own analysis, action oriented, set targets work hard in teams to achieve tasks (Fig 3-4). As published in various researches that internal motivation is an important stimulus for use of self-regulation strategies and better academic performance.[27] Madahvi reported that some medical students are ready for self-directed learning, others lag behind. The scores for 'desire for learning' and 'self-control' were higher compared to 'self-management' stressing the need to focus on this skill by teachers.[28]

The self-directed learners take control and accept the freedom to learn what they view as important for themselves.[29] Students' demonstrated high desire for learning and self-control, yet the self-management skills needs further improvement which can be achieved through multidisciplinary approaches.[30]

CONCLUSION

This study highlights the importance of self-directed learning and self-regulation in the context of preferred learning style. The influences of external and internal factors on learning strategies and self-efficacy are important aspects to consider when designing online courses. Factors such as pedagogical design, clarity of purpose and goals and guidelines were important as well as continuous opportunities for communication and collaboration.

Additional Information

Consent was obtained by all participants. College of Medicine Ethics Review Committee issued approval CMHS/REC/037/19C.

Disclosure

Conflicts of interest

All authors have declared that no financial support was received from any organization for the submitted work. Financial relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.

Other relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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