

## ORIGINAL ARTICLE

## CHANGES IN LEARNING STYLE PREFERENCES OF POSTGRADUATES AFTER ENTERING A NEW LEARNING ENVIRONMENT

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**Background:** The aim of this study was to investigate whether the learning style preferences of post-graduate medical students change with time when they enter a new learning environment. The learning styles of post-graduate medical students from Pakistan were assessed on Kolb's Learning style inventory and prospectively monitored for any change when the students entered a degree program at the University of Glasgow. **Methods:** Medical doctors from Pakistan who joined post graduate program in Evidence Based Medicine and Health Professions Education participated in the study. Kolb's learning style inventory was used to evaluate the learning preferences. Learning styles were evaluated twice in the study, in the first term of the course and then at the end, with a time span of 7 months. **Results:** The predominant learning style preferences of students were 'Assimilating' type, both at the beginning and at follow up. Some change in the learning style preferences of students was noted as 2/10 students moved to a different learning grid at follow-up. These results were assessed against gender, clinical and teaching experience using linear regression however no significant correlation was found. **Conclusion:** There was not enough evidence to suggest that learning style preferences of students change in a meaningful way after coming to a new learning environment. This study however, leads to a suggestion that further large sized longitudinal study should be done with enough statistical power to accept or reject the null hypothesis.

**Keywords:** Learning Styles; Learning Style Inventory; Kolb, Experiential Learning Theory; Medical Education

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### INTRODUCTION

In recent years, medical curriculum and teaching has gone through significant changes. An increasing integration of medical curriculum and a better understanding of the process of learning has been the driving force behind these changes. The focus of medical education has shifted to student-centered teaching methods where individual students process and learn new information in their own unique ways. The main aim of education is to provide a learning environment that equips students with skills of self-learning using their own preferred learning methods. This has led to the concept of 'learning styles'. The term 'learning styles' can be defined as different and unique ways used by individuals who prepare to learn and recall any information.<sup>1</sup>

Since 1960s, many psychologists have focused on analysing learning psychology and presented many learning theories.<sup>2-4</sup> One of the most commonly referred theory of learning is the 'Experiential learning theory (ELT), presented by the American psychologist David A. Kolb. David Kolb in his work has explained the Experiential Learning Theory (ELT), how this knowledge can be used to enhance learning and how the learning style

preferences change with the changing situations. ELT defines learning as, '*the process whereby knowledge is created through the transformation of experience*'. Kolb's Learning Style Inventory (LSI) is one tool to measure the learning style preferences of learners. The LSI provides basis for the validation of the Experiential Learning Theory (ELT). Learning styles or learning preference of people is a dynamic process and people change their learning style with changing circumstances or 'the learning space'.<sup>5</sup> He described learning as the learners preferred method of perceiving (grasping experience) and processing (transforming experience). This model further describes two different modes of grasping experience, i.e., Concrete experience (CE) and Abstract Conceptualization (AC) and two modes of transforming experience, i.e., Reflective Observation (RO) and Active experimentation (AE). These four modes are placed such that a continuous cycle of learning forms. Every learner touches all the modes during the process of learning in a circle. Some learners give preferences to some specific modes, which depend on personality types and situations in which learning is done.<sup>6</sup> It is hypothesised that the learning style preferences of learners are not rigid and students modify their learning styles based on

their past experiences, the learning environment and the information to be learnt.

A number of descriptive studies have assessed students' learning style preferences and few have assessed changes in learning styles over a period of time.<sup>7-15</sup> To our knowledge, no one has tested if any change exists when post-graduate medical students enter a new learning environment where ELT-based curriculum is taught and whether students' awareness of their learning style preferences affect this change. We conducted a longitudinal study to answer the following questions:

1. What are the learning style preferences of post-graduate medical students?
2. Do the learning style preferences of post-graduate medical students change when they enter a new learning space?
3. Whether awareness of their own learning styles affect the change in learning style preferences over time?

## MATERIAL AND METHODS

Written informed consents were obtained from the participants. Keeping in view the study design, formal approval from ethics committee was not obtained.

A group of post-graduate medical students was simultaneously enrolled in the University of Glasgow (UoG) in July of 2010 in two different courses, 'Evidence Based Medicine (EBM), and Health Professions Education (HPE); both of these taught courses are taught in lectures, small group discussion, self-directed learning and peer-assisted learning formats. The course curricula were designed based on David Kolb's Experiential Learning Theory. Students were given hands-on experience of a problem where students participated in solving it. Subsequently, students were asked to write reflective portfolios, allowing them to reflect. Assignments were given to help students conceptualize. Research projects were given to allow students to experiment with the skills.

### Evidence Based Medicine:

EBM course curriculum was designed with 9-intended learning outcomes (ILOs), aimed to enhance the understanding and capabilities of students in 9-generic areas of medicine and research. These areas were:

1. Critical appraisal skills
2. Medical epidemiology
3. Literature review skills
4. Information and communication technology and telemedicine.
5. Understanding and application of statistical methods.
6. Diagnostic methods

7. Medical ethics
8. Good clinical practice
9. Medical research philosophy and methods.

During term time, students were given lectures and were exposed to various teaching and assessment methods. Theoretical information was delivered in lectures with the help of 'PowerPoint presentation' and/or on blackboards. Assignments were then given to students to apply the theoretical information in hypothetical clinical scenario to check the understanding, analysis and problem-solving capabilities. Both formative and summative assessment methods were applied to assess these assignments. Student led 'Peer Assisted Learning (PAL) workshops were carried out every week to encourage student participation, communication skills and PAL. The topics of PAL workshops, PowerPoint presentations and research proposals were chosen by students themselves, to encourage self-directed learning.

### Health Professions Education (HPE):

This taught course included weekly lectures on five basic blocks of medical education, namely:

1. Gathering evidence
2. Learning
3. Teaching
4. Assessment
5. Curriculum

The lecture setting was a small group tutorial type with didactic lectures, mind mapping and interactive discussions. Each block was taught over a period of one month and at the end of each month, the students were asked to submit a reflective portfolio on the topic. This portfolio included a general discussion on the topic of interest and students' reflection on the application of a theoretical model in their own work environment.

### Library and residence:

UoG library provided the environment of learning for students with books and electronic databases on medical education and research. UoG has subscriptions to relevant medical literature published online and on paper. The students lived in shared flats which were in close proximity to the UoG main library and campus. In flat-share, eight out of 10 students shared two flats which were in the same building block. Thus, at their homes, students had a close contact with each other and they participated in group discussions and shared opinions on EBM and HPE.

The students involved in this study were enrolled into EBM and HPE course in the year 2010 and participated in the study during the first term. The students belonged to Khyber Pakhtunkhwa province of Pakistan and had variable clinical and teaching experience. A total of 10 students shared

both courses. LSI questionnaire was distributed to them at the beginning of the course and the response rate was 100%. Follow up LSI questionnaire was distributed after 7 months of first assessment and the response rate this time was 70%. These 70% (n=7) were included in the results.

Kolb's LSI was used twice to measure the learning style preferences of the students. After the follow up assessment, a questionnaire was distributed amongst the students to determine their own opinion of LSI and their reflection on the whole study as experts of medical education.

Kolb's learning style inventory questionnaire was provided in the class. The students filled the LSI questionnaire at the start of study in November, 2010 and then after 7 months at follow up in May, 2011. Estimated time of administration was 10 minutes, and participants were asked to rank their responses in order of preferences, 4 being the most preferred and 1 being the least. Participants were reminded that there were no right or wrong answers and this inventory was a self-assessment exercise.

The follow up questionnaire was designed to explore the inventory question with regards to language used in LSI, the interpretation and placement of the responses in various quadrants and if the students' awareness of the learning cycle influenced their learning style preferences. Besides demographic data, the responses were either coded on 5-point Likert scale or were open-ended with responses written on empty space provided. The responses on Likert scale were evaluated as quantitative data and the written responses were analysed as qualitative data. The questions are as under:

1. Before reading about /filling the LSI, did you ever think of your learning style preferences?
2. You were able to clearly understand what the question actually meant to you?
3. Do you think LSI adequately depicted your learning style preferences?
4. After being aware of the Kolb's learning styles, you consciously tried to change your learning styles?
5. Do the questions adequately put you in one of the quadrants?
6. If you know the learning style preferences of your students as a teacher, it would be more helpful to you in teaching?
7. Did your learning style preferences on the learning style grid change after coming to this course?
8. How has the knowledge of your learning styles of any benefit to you?

9. Would you like to add something about the Kolb's theory of experiential learning and the Learning Style Inventory?

This questionnaire was filled at re-test along with LSI questionnaire.

Learning styles were assessed on LSI grid on the basis of two axes (AC-AC and AE-RO) by respondents themselves. The results were transferred to a master grid where responses of all the participants were plotted (Figure-1). Data coded on Likert scale and other quantitative results were analysed on SPSS v. 17. Paired t-test was done to determine the difference in learning quadrants at start and follow up. Correlation and regression was used to measure the effects of age, gender, clinical experience and teaching experience. Qualitative data including the description of answers were coded later and analysed through content analysis after reading the detailed questionnaire, taking into account their LSI quadrants and change in LSI preferences.

## RESULTS

Total of 7 respondents completed both questionnaires. Mean age of the respondents was 29.4 years with minimum of 28 and maximum of 32 years. The subjects had a mean clinical experience of 25 months and a mean teaching experience of 15 months. Of 9 subjects, 8 were males and one was female.

The learning style preferences of the students at the start of the study are presented in table 2. Most participants fell in 'Assimilating category (4/7), two were converging while one was accommodating. The mean of the two-axis score of the sample fell in assimilating quadrant.

The learning styles of students converged towards 2<sup>nd</sup> quadrant in the follow up test, as this time 5 students were assimilating type and two were accommodating type. Notably, two students previously in converging quadrant had moved to accommodating and assimilating respectively. Individual students as well as sample mean learning style movement is shown in figure-1. However, this did not reach statistical significance ( $p=1$ ). Movement on single grids was evaluated through paired *t*-test and the difference on AC-CE axis was 2.57 ( $p=0.15$ ). Similarly, the difference between AE-RO axis was 0.38 ( $p=0.8$ ) (Table-2). The differences in AC-CE and AE-RO axes were partially attributed to age, clinical experience and teaching experience, but again, the *p*-value was insignificant on regression analysis (not shown).

Second questionnaire was given to the students to evaluate their own knowledge and perceptions of students of medical education on this case study and Kolb's theory on experiential learning. This

questionnaire was relevant as the students were not only participating in this case study but also, they had read about ELT as part of their course.

Initial questions were about the validity of the inventory. Students were asked if they were able to clearly understand what the question actually meant to them. 6 agreed or strongly agreed to the question while one was unsure. In response to the question, ‘Do you think LSI adequately depicted your learning style preferences?’ most students agreed to this statement, with six students agreeing or strongly agreed to the statement while one was unsure. An open question was asked, what factors might have influenced their learning styles. Response rate to open ended questions was low and only four participants responded. Three were of the opinion that the study environment and circumstances might have influenced the change in the learning style preference. Three students elsewhere, raised some doubts on the ‘test-retest reliability’ language and validity of the inventory. One student wrote that Peer-assisted learning might have changed their learning quadrant.

The next question was if after being aware of their own learning style and reading about the ELT, they consciously tried to change their learning style. Three students agreed or strongly agreed to this while two students were unsure. Two students disagreed with the statement. Students were asked if the inventory adequately put them in one of the quadrants. Six students disagreed or strongly disagreed to this statement while only one student agreed to this statement.

In a question about the use of learning styles in their teaching, they were asked if as teachers, they knew the learning styles of their students, it would have been helpful to them in teaching. Six students agreed or strongly agreed while only one disagreed to the statement. While describing their choices, agreeing students were mostly of the opinion that knowing their students’ learning style would help them in choosing appropriate teaching style which would complement their students’ learning style. One

respondent wrote, ‘I would be able to teach according to their learning needs’. One student who disagreed to the statement wrote, ‘as in one class there are more than 50 students so you cannot concentrate on few students on the basis of their learning style.’

The last question stated, ‘Would you like to add something about Kolb’s theory of experiential learning and the LSI?’ Seven participants responded to this question. After a content analysis of the written description it was inferred that participants believed this model was too theoretical and had no practical implications. One student wrote,

‘Kolb’s model is more of theoretical interest but in reality, it may not be of that help for the reason that the outcome result is that the learning styles change (frequently), so one cannot clearly state what his/her learning style was and how it was affected. The other problem is that the points in different quadrants are overlapping which decreases the sensitivity, specificity and validity.’

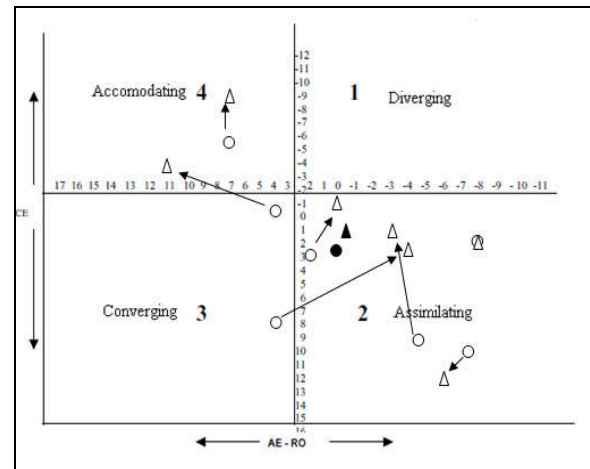


Figure-1: Movement of learning styles on learning style grid (modified from Kolb 1976).

Key: Empty circles: Individual results at start, empty triangles: Individual results at follow up, Black circle: Sample mean at start, Black triangle: Sample mean at follow up.

Table-1: Frequencies of learning style preferences at start and follow up. Compared to three studies on medical residents.

Learning quadrant	Participants at start	Participants at follow up	Laeq <i>et al</i> <sup>15</sup>	Engels and Gara <sup>16</sup>	Gurpinar <i>et al</i> <sup>14</sup>
Diverging	0 (0%)	0 (0%)	09%	05%	48%
Assimilating	4 (57%)	5 (71%)	14%	05%	41%
Converging	2 (29%)	0 (0%)	56%	65%	06%
Accommodating	1 (14.3)	2 (29%)	19%	25%	05%

Table-2: Paired sample t-test for difference between measurements at the start and follow up

Variables	n	Mean	SEM	SD	Difference	p
Pair 1: Learning quadrant at start: Learning quadrant at follow up	7				0	1
Pair 2: AC-CE at start: AC-CE at follow up	7	2.6	1.6	4.1	1.65	0.15
Pair 3: AE-RO at start: AE-RO at follow up	7	0.28	1.9	4.9	0.14	0.883

Key: n=Number of respondents, SEM: Standard error of mean, SD= Standard Deviation

**Table-3: Questions with Likert scale responses.**

Questions:	Respondents						
	1	2	3	4	5	6	7
1. You were able to clearly understand what the question actually meant to you?	A	SA	A	N	SA	A	A
2. Do you think LSI adequately depicted your learning style preferences?	A	SA	A	A	SA	N	A
3. After being aware of the Kolb's learning styles, you consciously tried to change your learning styles?	A	A	A	D	N	D	N
4. Do the questions adequately put you in one of the quadrants?	A	D	D	D	SD	D	D
5. If you know the learning style preferences of your students as a teacher, it would be more helpful to you in teaching?	A	A	A	A	A	D	A

Strongly agree: SA, Agree: A, Not sure: N, Disagree: D, Strongly disagree: SD

## DISCUSSION

The purpose of this study was to investigate students' learning preference over their academic course of study over a modest time period and to identify as to what direction their learning styles might shift. The learning style preferences showed assimilating style to be the most prevalent. This is discordant with some recent research on medical residents, which shows that there is great variability of results in the literature. This could be due to the differences in the learning spaces of the other studies which were conducted on residents in clinical fields of medicine and surgery. On the other hand, a lack of validity and reliability could also lead to such results and so a small sample size. Contrary to this, the mean of the sample falls in assimilating quadrant (Figure-1), similar to Kolb's reference for health professionals. Clustering of the participants in the assimilating quadrant could be explained by the reason that the students had received their basic medical qualification in a lecture based system. All but one had taught in a conventional lecture-based system. Lecture based system in undergraduate curriculum required understanding scientific concepts and memorizing facts and little importance is given to hands-on experience in clinical departments.

The result of the change of learning styles lend mixed support to previous literature. Published research shows that there is some change in the learning styles of students over course of academic career. In this study, no significant change was evidenced over time in the learning style preferences of students either between quadrants or over AC-CE or AE-RO axis on Kolb's learning grid. However, this change is minimal with a high p-value so the null hypothesis cannot be rejected. Reflecting upon this relative stability of the scores, few issues can be pinpointed:

- Sample size: The sample size was small and might not have detected a significant difference as a result of type II error.
- Learning environment: The two courses the students took required substantial amount of reflective writing and conceptualization of the research process and not much practical work

was done during the term. Since, the majority of students were already 'assimilating' type which is a combination of RO and AC, the course did not affect the learning styles.

- Time factor: Total duration of the study was 6 months, which may not be enough to show significant changes in the students' learning styles. Marriot<sup>17</sup> showed significant change while Geiger and Pinto<sup>18</sup> showed no significant change over a period of three years.
- Selection of tool: Kolb's LSI is said to be a self-assessment tool and not a measuring instrument. Although there has been evidence of discriminant validity<sup>19</sup> nonetheless, the validity of the inventory has been criticized.<sup>20</sup>

To summarize, learning style preferences of post-graduate doctors from Pakistan enrolled in a taught course at the University of Glasgow have been analysed over a period of time. The change in learning style preferences when the participants entered a new learning environment is measured for significant movement across learning style grid (after Kolb). However, keeping in view the small sample size, and that the research question has been tested for the first time on students from a developing country entering a developed country, the scope of further research is large.

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## AUTHORS' CONTRIBUTION

YMY: Performed research, analysed data and wrote manuscript. NB: Analysed data and wrote parts of manuscript. SF: Revised manuscript. AA: Revised data analysis and manuscript.

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