Assessment of Learning Style Preferences and Their Influence on Gender & Academic Performance among First Year Medical Undergraduate Students

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Abstract: Background & Objectives: To maximize the education value of medical teaching it is necessary to understand our learners' preferred mode of learning and facilitate them with the best possible way. Our objective was to assess the learning style preferences of first year MBBS students and study the influence of learning styles on gender & academic performance. Methods: We administered Honey & Mumford's 80-point learning style questionnaire to 150 first year medical students (87 females & 63 boys) of our institute. We studied correlation of learning styles with gender & academic performance with ANOVA & Chi square tests. Results: 58% of our students were Unimodal (single 'very strong' preference), 28% Bimodal (two 'very strong' preferences) & 13% Multimodal (more than two 'very strong' preferences). 'Activist' was the most preferred style among unimodal learners & 'Reflector/theorist' among bimodal learners. Gender differences were evident among the Unimodal vs. Bimodal/Multimodal learners. Statistically significant difference was observed within the unimodal group with reflectors as highest achievers. No significant difference in the exam grades of Unimodal, Bimodal & Multimodal learners was evident. Conclusion: We have a diverse group of learners and understanding their learning preferences will help in catering to their learning needs. [Mrunal S NJIRM 2017; 8(1): 109-115]

Key Words: academic performance, gender, Honey & Mumford questionnaire, learning styles, medical students.

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Introduction: Learning style adapted by an individual describes how the person acquires, stores & processes information. Learning styles not only influence how individuals learn, but also are important for teachers to develop suitable teaching strategies. During first year medical curriculum, students are exposed to different learning environments like didactic lectures, tutorials, group discussions, practical etc. Moreover, they may have diverse learning needs. If the students feel that they gain something from their learning environment, their approach towards learning might change.

There are numerous & diverse inventories of learning styles reported in the literature[1]. Honey and Mumford's 80 point extensive Learning Style Questionnaire (LSQ) has been proposed as an alternative for Kolb's Experiential Learning Style Model (ELM) and a later refined version (LSI-1985)[2]. Itclassifies learners into four major groups i.e. Activists, Pragmatists, Theorists & Reflectors. These four styles correspond approximately to those suggested by Kolb's (1999) Experiential Learning Model (ELM): active experimentation (Activist), reflective observation (Reflector), abstract conceptualization (Theorist), and concrete experience (Pragmatist) [3, 4]. Each of these has its strengths & weaknesses and own suitable instructional strategies[5]. Literature reveals that student motivation & performance improves when instruction is adapted to student learning styles[6-9]. Kappe et al. showed that data generated by the use of LSQ could effectively be used to generate appropriate, matching learning activities and instructional strategies[10]. Recent thinking in this area suggests that instead of matching training to the styles of the learners, it could be more rewarding to expose learners to a mismatched learning environment in order to help them develop a wider repertoire of coping behaviours and learning strategies[3]. To get the best out of the students, teachers need to understand the learning styles of the students and facilitate them with the best possible way. We can also train them to adapt a style in learning in which they are weak as learning styles can change and do not necessarily stay the same[11].

Literature search reveals that lot of studies have been done to understand students' preferred sensory modality of learning using VARK questionnaire, but assessment of learning styles using Honey & Mumford's questionnaire is less explored especially in an Indian set up. Therefore, we had undertaken this descriptive study to assess the learning style preferences of first year medical professionals and categorize them according to Honey & Mumford's classification of learning styles. We also studied the correlation between gender and academic performance with learning styles. This was an attempt to create awareness about learning styles among the faculty as well as the students.

Methods: Study objectives were, 1)Toidentify Learning style preferences of First year medical professionals.2) To study the correlation if any, between gender & academic performance with learning styles.

The study was conducted in the Dept. of Physiology, Smt. KashibaiNavale Medical College & General Hospital (SKNMC & GH) Pune, Maharashtra, India. Participants of this study were newly admitted first Year M.B.B.S. students (n=150). The study was approved by the Institutional Ethics Committee. All the participants were informed about the details of the study before enrolling. It was a questionnaire based observational study and we used the Learning Style Questionnaire (LSQ), a globally accepted tool for assessing learning styles, designed by Peter Honey & Allan Mumford after taking necessary permissions[12].

Details about the Study Instrument: The Learning style questionnaire by Honey & Mumford consists of 80 questions. The responses have to be given in the form of either AGREE (by giving a √) or DISAGREE (by giving a ×) in front of the question. Depending upon the responses to these 80 items, four different learning preferences have been described namely, Activists, Reflectors, Theorists & Pragmatists. Each of these has its own learning characteristics, strengths & weaknesses. [Ref: Annexure-1]

Method: The format of the Learning style Questionnaire was explained to the participants and their queries regarding the questions were answered. They were asked to answer each question in the form of × or √ honestly, as accuracy of the result would be dependent on it. Participants were given approximately 20-30 minutes to fill the questionnaire. For each "agreed" answer, one point was awarded and no point was given for "disagreed" responses. Their responses were assessed according to the given scoring & interpretation pattern. [Ref: Annexure-I]. The questionnaires of all the students were analysed to find out their very strong, strong, moderate and low preference towards a particular learning style. For analysis, we have taken into consideration only the 'Very Strong' learning style preference. Students having only one 'very strong' preference were termed as students with 'Unimodal' preference and grouped into four groups i.e. Activists, Reflectors, Theorists& Pragmatists. Some students had two 'Very strong' preferences; they were grouped as students with 'Bimodal' preference. Those with three or more 'Very strong' preferences were grouped as 'Multimodal' group.

We also grouped the students according to their gender and learning style preferences and studied the correlation between the two. To study the correlation between academic achievement & learning styles, we used the average marks (%) of the two internal assessment exams, which are conducted for the first year students on routine basis and the combined marks of all three subjects of first year from the final exam conducted by Maharashtra University of Health Sciences [MUHS].

Statistical analysis: Master chart was prepared using Microsoft Excel 2010 and data was analysed using Epi info software. For qualitative data, proportions were calculated and appropriate test of significance was applied. For quantitative data, mean & standard deviations were calculated and appropriate test of significance was applied. $p< 0.05$ was taken as statistically significant.

Result: The total no. of students who participated in the study was 150, out of which 87 were girls & 63 boys. Out of these 150 students, 87 students (58%) showed single 'Very strong' learning style preference (Unimodal), 43 students (29%) showed two different styles as their 'very strong' preference (Bimodal). Rest of the 20 students (13%) showed combinations of more than two different styles as their very strong preference (Multimodal), out of which two students showed preference for all four learning styles. [Fig 1]
Amongst the unimodal learners (n=87), the order of preference for learning styles was Activists [40.2 %(n=35)], Theorists [28.7 % (n=25)], Reflectors [21.8% (n=19)] and Pragmatists [9.1% (n=8)] [fig 2]Amongst the Bimodal 43 students, 15 were Reflector/theorists (R/T), 7 Reflector/ Activists (R/A), 6 belonged to Pragmatists/Activists (P/A), Reflector/Pragmatists(R/P) & Theorists/Activists (T/A) each and 3 showed preference for Pragmatist/Theorist (P/T) style. [Fig 3]Distribution of students (n=20) showing multimodal learning style preferences is shown in [fig 4].

[II] **Distribution of learning styles according to gender**: Both males and females were predominantly unimodal. However, number of females with bimodal preference was more as compared to males while number of males with multimodal preference was

more [Table I]. Chi square test, applied to study the correlation revealed a p value < 0.05 i.e. statistically significant. We also analysed the gender distribution within the four unimodal learning styles. Both males and females showed preponderance towards activist style. The second preference was reflectors in males while theorists in females. [Table II] Correlation was statistically non-significant as per chi square test. III]

Influence of learning styles on academic achievement: We compared the mean percentage marks (theory & practical) of unimodal, bimodal & multimodal learners. [Table III]. For this, we used the average marks of the two routinely conducted internal assessment exams. Although bimodal learners showed higher mean percentages, ANOVA test applied for correlation was found to be statistically non-significant (>0.05).

Table I: Chi square test for correlation between Learning Styles and gender

Learning styles	Females n(% within gender)	Malesn (%)	x^2	p value
Unimodal	50 (57.5%)	37 (58.7%)	6.797	.033*
Bimodal	30 (34.5%)	13 (20.6%)		
Multimodal	7 (8%)	13 (20.6%)		
Total (n=150)	87 (100%)	63 (100%)		

*p < 0.05 is significant

Table II: Gender Vs Unimodal Learning Styles

Unimodal learning styles	Femalesn (%)	Malesn (%)	Total(100%)	x^2	p value
Activist (A)	20 (40)	15 (40.5)	35	3.054	.383*
Reflector (R)	8 (16)	11 (29.7)	19		
Theorist (T)	17 (34)	8 (21.6)	25		
Pragmatist (P)	5 (10)	3 (8.1)	8		
Total87 (100%)	50 (57.5%)	37 (42.5%)	87 (100%)		

*p value>0.05 - N.S. (Non-significant)

Table III: ANOVA test for learning styles and Theory & Practical %

Learning style		Unimodal(n=87)	Bimodal(n=43)	Multimodal(n=20)	Total (n=150)	F	p value
Theory	**Mean %**	53.7	56.9	53.7	54.7	1.45	>0.05*
	S.D.	9.9	10.4	10.7	10.2		
Practical	**Mean %**	58.0	59.3	58.4	58.4	0.38	>0.05*
	S.D.	8.3	7.9	7.2	8.0		

*NS (p value >0.05 is statistically non- significant)

Table IV: ANOVA test for Internal assessment Theory & Practical % and University exam % within Unimodal Learning styles

Learning style		Activist (n=35)	Theorist (n=25)	Reflector (n=19)	Pragmatist (n=8)	Total (n=87)	F	P Value
Theory IA	Mean %	51.0	55.2	56.1	55.3	53.7	1.5	>0.05*
	S.D.	9.9	10.2	8.9	10.0	9.9		
Practical IA	Mean %	54.6	58.9	61.3	61.8	58.0	3.9	.012**
	S.D.	7.4	6.9	9.1	10.0	8.3		
University exam	Mean %	62.5	65.2	67.4	66.3	64.7	2.72	.049**
	S.D.	6.1	7.1	5.9	6.1	6.6		

*NS (p value > 0.05 Non-significant), **Significant (p value < 0.05 Significant).

We compared the theory & practical percentages of the internal assessment exams within the unimodal learners e.g. activists, theorist, reflectors & pragmatists as each of these has marked specific learning characteristics. We also compared the total percentage marks of students (Combined marks of all 3 subjects) from the first year university (MUHS) exam [Table IV]. ANOVA was applied to study the

correlation. In all these exams mean theory as well as practical percentage of reflectors was highest followed by pragmatists and theorists. Activists showed least mean percentage. This difference was statistically significant for practical percentage and university exam percentage.

Discussion: First objective of our study was to identify the predominant learning style of first year medical students using Honey & Mumford's LSQ. This questionnaire identifies four major learning styles, Activists, Theorists, Reflectors & Pragmatists. Our students showed preference for all these styles in diverse proportions. Majority of them showed a single predominant (very strong) learning style preference i.e. 58% belonged to unimodal category, 29% showed bimodal preference for two different styles and 13% showed preference for three different or even all four learning styles. Amongst the unimodal learners (n=87), order of preference was Activists (40.2%), Theorists (28.7%), Reflectors (21.8%) & Pragmatists (9.1%). Our findings are similar to those obtained by other studies, who assessed the learning styles of medical students where more number of participants showed a single predominant learning style as compared to mixed preference[13,14,15].However, all these studies showed 'Reflector' as the dominant learning style, which is in contrast with our findings where Activists are more in number. This also contradicts the fact that Asian students are passive, mostly reflective learners rather than active learners[15]. However, our findings go with those of Irfan Shukr et al who found that activist is the most preferred style of learning in medical undergraduate students as compared to the Reflector style amongst postgraduates[16]. Similar to them we also found least preference for the 'Pragmatist' style.
Activists involve themselves fully in new experiences without bias, are open minded, non-sceptical and this makes them enthusiastic about anything new. At the same time, they have a tendency to take immediate actions without thinking & sufficient preparation, tend to get bored with implementation. Our learners enter the medical profession at an age of 18-19 years when they are enthusiastic about learning new things and that might be the reason for more no of activists. Theorists are comparatively rigid, do not deviate from their typical mind set and avoid subjective judgements and anything flippant. They have a disciplined approach but are restricted in lateral thinking. Reflectors are good observers, thorough & methodical; tend to assimilate things before jumping to conclusions. Due to this they tend to be 'back-seaters' and do not actively participate in meetings/discussions. Pragmatists are practical learners who tend to conceptualize their ideas and enjoy problem solving & decision-making.

Honey & Mumford's questionnaire is based on Kolbe's learning model, which describes a four stage learning cycle[4]. These four stages are mutually corresponding with the four styles described by Honey & Mumford, activists, reflectors, theorists and pragmatists. According to Kolbe, our propensity to reconcile and successfully integrate the four different styles improves as we mature through our development stages. Our students have shown least preference towards Pragmatist style. This might be due to assessment just at the entry level and we might found the change as students proceed to final year. Although the number of students with unimodal preference is more, our study showed a significant number of students with mixed preference. About 29% showed bimodal preference with Reflector/theorist (most common combination according to Honey & Mumford) as the most preferred style and 13% showed very strong preference for three as well as all four learning styles. Such mixed preference has also been noted by studies on medical students[14], pharmacy students[17] and management students[18]. However, their number is low as compared to our study. The diversity of learner group suggests the need for modifying our teaching strategies to suit all our learners.

Gender & learning styles: The influence of gender on learning styles is an area of active research. Our study revealed that both males & females had predominant unimodal preference followed by bimodal and multimodal preference. However, the number of female bimodal learners was more as compared to that of males. On the contrary, more number of males showed multimodal preference than females. That reflected in the ANOVA test applied for correlation that came out to be statistically significant. Many studies had discussed about the correlation between the gender and their predominant learning style. A study on physiotherapy students using three different inventories shows that gender influences learning style preference, with males seeming to process information in different ways than females[19]. According to researchers, males prefer rational evaluation and logic, whereas females use

"elaborative" processing in which they tend to seek personal relevance or individual connections with the material being taught[20]. Males tend to be more achievement oriented, whereas females are more socially and performance oriented[21].

In yet another survey, there was a significant difference between the learning styles and gender[22]. Other studies on undergraduate medical students using VARK questionnaire showed that male and female students have significantly different learning styles[23, 24]. Males are predominantly multimodal while females prefer unimodal styles. A study on optometry undergraduates also shows that learning styles are influenced by gender[25]. We also tried to correlate different unimodal learning styles amongst males & females. No of activists was almost similar, but there were more reflector males as compared to females and vice versa for theorists. However, the difference was not statistically significant. These findings go with the study in medical students in Pakistan, which showed some preponderance of males in reflector style, and of females in pragmatist style, however this difference was not significant[26].

A study among Arabic language students also revealed that gender does not influence learning styles, which may be due to the form and requirement of the curriculum contained in the subjects taken[27]. Similar results are found in a study on pharmacy students, where gender does not show any influence on learning styles. Therefore, on one hand we have results showing that there is some influence of gender on preferred mode of learning when we classify unimodal vs. bi & multimodal learners. On the other hand, when we grouped them according to four different unimodal styles, the difference was non-significant. We sincerely feel that this area should be explored more, especially using Honey & Mumford's LSQ.

Learning styles & academic achievement: It is well acknowledged that assessment motivates learning[28]. Therefore, we tried to analyse the relationship between assessment outcome, which is measured in terms of exam scores, and learning styles.

We analysed the scores of internal assessment exams as well as University exams conducted by MUHS, Nashik. The internal assessment exam comprised of theory exam in Physiology with MCQs, SAQs and LAQs and practical exams along with theory viva. For MUHS exams, we considered the total percentage of marks obtained for all three subjects i.e. Anatomy, Physiology and Biochemistry. There was no significant difference between the theory and practical percentages of unimodal, bimodal and multimodal learners. We could not find much literature on this, as very few studies have mentioned about mixed preferences using honey & Mumford's questionnaire.

Analysis of exam scores of unimodal learners revealed that 'Reflectors' scored higher in theory as well as practical followed by Pragmatists, although, the difference was statistically significant only for practical marks. Activists scored least amongst the four. For university exams, again the reflectors showed higher mean percentages followed by pragmatists, theorists and activists. This difference was statistically significant. Literature review has shown varied results as far as learning styles and academic performance is concerned. Our findings go with the findings of Jiraporncharoen W, Angkurawaranon C et al who found that reflective learning style was associated with high academic achievement among preclinical students but not with that of clinical students[29].

Similar findings were reported in a study on Hong Kong GPs[13].A study on fifth grader medicine students found that there is no correlation between learning styles and academic achievement but best academic performance tended to be achieved by reflectors[30]. There are also studies with the findings that learning styles do not influence academic performance[31,32]. Although our study has shown a significant relationship between academic scores within the unimodal learners, we cannot forget the significant population of learners with mixed (Bi and multimodal) preferences where correlation needs to be studied in future. As suggested by Kolbe, no single style is superior over others. Students should learn to inculcate other non-dominant styles as well, to learn better and achieve success. Researchers suggest that individualization of instructional method does not contribute significantly to learning outcomes. Hence, to enhance learning maximally, one must try to use a mixed method approach[33]. There should be a 'constructive friction' between the preferred styles and instructional strategy[34].

Conclusion: Majority of first year medical students have unimodal learning style preference with activist

style as most common followed by theorist, reflector & pragmatist in this particular cohort of students. At the same time, a significant proportion of students also showed bimodal preference with reflector/theorist as the most common preference while rest of the students showed multimodal preference. Gender difference was evident in unimodal vs. bi/multimodal students but there was no significant gender difference amongst the four types of unimodal learners. Significant correlation was seen between learning styles and academic achievement amongst the unimodal learners with reflectors as high achievers followed by pragmatists, theorists and activists. We would like to stress here that our aim was not to prove that one particular learning style is better over other, rather each student should try to modify his/her natural style to be able to perform effectively. Our study was first of its kind attempt in our institute that gave an insight into the learning preferences of our students' right at their entry level. We believe that, understanding students' learning styles, catering to their learning needs and creating deliberate friction by exposing them to different teaching learning environments would enhance learning.

Limitations: We believe that mere understanding of the learning styles is not enough; rather the knowledge should be utilized for continuous on-going programme for effective learning by the students. Because of time constraints, we could not study the effect of different mismatched teaching strategies in the learning process of our students. We would also like to follow up the same cohort of students until their final year to find out whether learning styles change over a period of years. Another limitation that we observed was Honey & Mumford's LSQ does not contain direct questions about respondent's learning but addresses general queries about an individual's general concepts & beliefs. Therefore, a combined use of this questionnaire with more commonly used ones like VARK questionnaire might be useful.

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