

Assessment of Learning Style in a Sample of Saudi Medical Students

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Original paper SUMMARY

Background: By knowing the different students' learning styles, teachers can plan their instruction carefully in ways that are capitalized on student preferences. The current research is done to determine specific learning styles of students. Method: This cross sectional study was conducted in Al Ahsa College of Medicine from 2011 to 2012. A sample of 518 students completed a questionnaire based on Kolb inventory (LSI 2) to determine their learning style. A spreadsheet was prepared to

compute all the information to get the cumulative scores of learning abilities and identify the learning styles. Results: The mean values of the learning abilities; active experimentation (AE), reflective observation (RO), abstract conceptualizing (AC) or concrete experience (CE) for male students were 35, 28, 30 and 26 respectively while they were 31, 30, 31 and 29 respectively for female students. There were significant difference between male and female students regarding the mean values of AE-RO (6.7 vs 1.5) and AC-CE (4.1 vs 2.1). This indicated that the style of male students

were more convergent and accommodating than those of female students. The female had more assimilating and divergent styles. Conclusion: Learning style in Saudi medical students showed difference between males and females in the early college years. Most male students had convergent and accommodating learning styles, while the female dominant learning styles were divergent and assimilating. Planning and implementation of instruction need to consider these findings.

Key words. Learning style, Saudi Arabia, Kolb learning style inventory

1. INTRODUCTION

Learning styles refer to cognitive, affective, and physiological behaviors that perform as relatively stable indicators of how people perceive, interact with, and respond to their environment in learning situations by recalling their stored information (1, 2). The current learning style models in the literature represent the three layers onion metaphor consisting of; instructional preferences through which they perceive information (outermost layer), information processing (middle layer) and personality (innermost layer) (3).

Many instruments were designed to measure different learning styles. One of the famous instruments concerned with the middle layer is the Kolb learning style model (4). In Kolb's model of experiential learning, learning involves a group of human activities including feeling, re-

flecting, thinking, and doing, where the person is required to employ each of the four key learning abilities: concrete experience (CE), reflective observation (RO), abstract conceptualization (AC), and active experimentation (AE). Individuals develop specialized preferences for such activities and abilities; that are called learning styles (5).

Any learning style is neither preferable nor inferior to another, but is simply different, with different characteristic strengths and weaknesses (6).

Education in Saudi Arabia is, notably divided along the line of gender. The division is in line with the attitudes of the Saudi society which is based on the Islamic principles that prohibit intermingling between men and women (7). Our institute, Al Ahsa medical College, King Faisal University is composed of two separate departments; one for

male and one for females to conform to the local cultural norm. The college started in 2001 with a traditional discipline based curriculum. During 2011-2012, the institution introduced the problem based learning (PBL) curriculum adopted from the University of Groningen, Netherlands.

One of the most common concerns all over the world is the dissatisfaction of both the students and teachers regarding teaching and assessment. Multiple variables may affect this phenomenon. *The current research was done to determine the student learning styles, and find if there was any difference between male and female students.*

2. METHODS

Settings

This study was conducted in Al Ahsa College of Medicine, King Faisal University, Saudi Arabia from

2011 to 2012. Al Ahsa Oasis is the largest constituent in the Eastern Region of Saudi Arabia where more than one million of population is present. Al Ahsa Medical College serves students from different regions of Saudi Arabia.

Subjects and Study design

A cross sectional design was used in this study. The population was the all students enrolled in the College of Medicine. The sample included all the students who accepted to share and returned a filled survey form. It included a total of 518 respondents from different academic years in the College (307 males and 211 females). The instructions for completing the form were clarified, to avoid random and chance bias during filling. The male and female researchers agreed on standard steps of explanation, assurance, form distribution and collection. The form was self-scored by the students. After explaining the aims of the study and the methods of data collection, all students were asked to return the distributed forms anonymously with only denoting the academic year. The female researcher helped to assure the female students and guarantee the same degree of non-biased form filling.

Instruments for determination of Learning Style

Kolb learning style inventory (LSI 2) (8) was used to collect the initial answers and ranking of each participant. Calculations were done to reach to the actual learning style. Validity and reliability of the LSI was previously evaluated and proved (9,10,11). The LSI is composed of 12 questions with four options from A-D per question. Each respondent was requested to complete the 12 sentences by ranking the four choices by assigning 4 to the phrase that is most like him, 3 to the one that next describes him, 2 to the next, and finally, 1 to the ending that is least descriptive of him. Each of these choices, correspond to one of the four learning abilities in a random and non-uniform pattern. The LSI employs a forced-choice method by which to measure an individual learning orientation toward four learning abilities representing a repetitive four-step cyclical process: concrete experience

(feeling) (CE), reflective observation (watching) (RO), abstract conceptualization (thinking) (AC), and active experimentation (doing) (AE) (8).

Calculations for determination of Learning Style

An Excel © spreadsheet was prepared by the second author to compute all the information and identify the cumulative score of each learning style category. The least possible score is 12 and the highest possible score is 48. The greater the score of the learning ability, the more significant that the students prefer to learn through this ability. The mean values of these abilities were plotted per all group and academic years in males and females on the X axis representing the AE and RO, while the Y axis represented AC and CE abilities. Learning style was presented as a diamond graph.

Furthermore, the scores were subtracted from one sum to the other in two dialectical or opposite abilities which describe a relative preferred way of learning. The value of AE-RO also shows how a person transforms and processes his learning experience with active experimentation abilities or reflective observation. The value of AC-CE represents how a person grasps learning experience either with abstract conceptualization or with concrete experience. The values of these subtractions were represented on a scale between +36 to -36. The + 36 or - 36 comes from subtraction of 48-12 or 12-48. The mean AE-RO and AC-CE values were plotted on a scatter gram in relation to x and y axes respectively. Kolb put cut-off points of 5.9 for AE-RO and 4.3 for AC-CE as the LSI normative scores, at which X and Y axes cross. (5, 8). A combination of two values of

AE-RO and AC-CE determines which of four learning styles persons prefer to use. The four learning styles were represented as convergent (CON), Assimilating (ASM), Divergent (DIV) and Accommodating (ACM)

Statistical analysis

Computing the values of learning styles was done by data entry to Microsoft Excel © spreadsheet. (Microsoft Corporation, USA). The values of the 4 dimensions; AE (Active Experimentation or Doer), RO (Reflective Observation or Watcher), AC (Abstract Conceptualizing or Thinker) and CE (Concrete Experience or Feeler) for all students were estimated. The mean values of AE, RO, AC and CE per academic year and gender were calculated and graphed to present the learning style area. The values of AE-RO and AC-CE for all students were plotted at the X and Y axes respectively. Crossing at AE-RO (5.9) and AC-CE (4.3) was graphed to decide the four quadrants of learning ability; convergent, assimilating, divergent and Accommodating learning styles. These values were decided based on the different cut off scores of the norms as presented by Kolb. SPSS (SPSS Inc, Chicago, Illinois) was used to get the descriptive statistics on the AE-RO and AC-CE and to perform t-test to determine if the differences in the scores between the learning styles. Significance was considered at $p < .05$ in this study.

3. RESULTS

Table 1 presented the number and percentage of sharing students divided by the academic year and by gender. The total students sharing in this study represented 65% of total students.

Table 2 and figure 4 presented the number of students per each of the four quadrants representing; convergent (CO), assimilating (AS), divergent (DV) and Accommodating (AM) learning styles per each academic year and in all the College and by gender. There dots in the convergent and accommodating quadrants of

	Females	Males	Total Participation (Sample)	Total students (Population)	% sharing
Second year	39	70	109	184	59.2
Third year	39	61	100	177	56.5
Fourth year	48	61	109	150	72.7
Fifth year	53	59	112	148	75.7
Sixth year	32	56	88	144	61.1
Total	211	307	518	803	64.5

Table 1 presented the number and percentage of sharing students

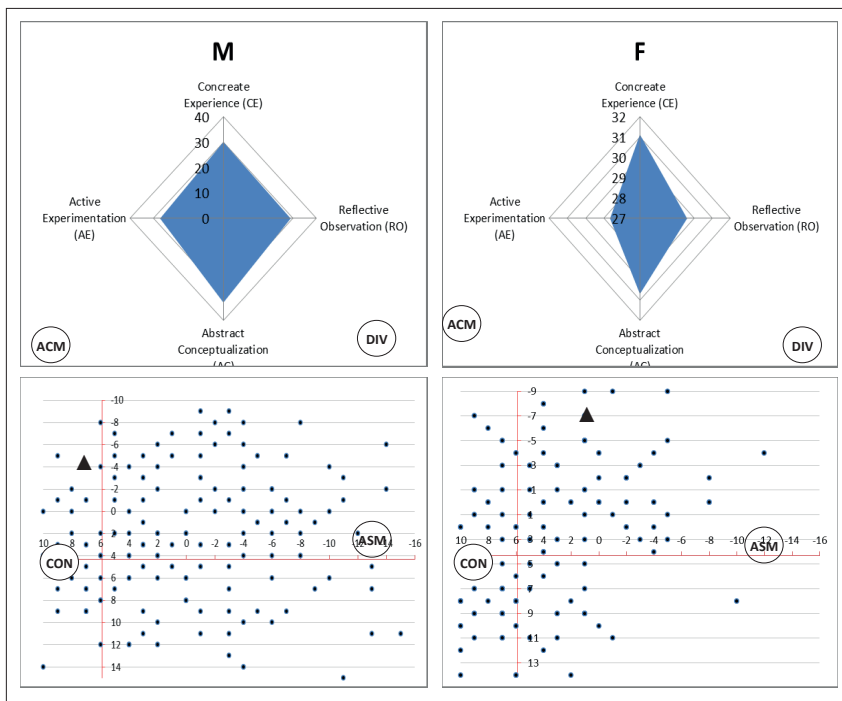


Figure 1: the mean values of the 4 dimensions AE, RO, AC and CE for all College students per gender (upper half) and Scatter graph of the distribution of the cross point between AE-RO X axis and the AC-CE Y axis. The mean value of cross point between AE-RO and the AC-CE was represented by a black triangle (▲). The 4 learning styles were represented by convergent (CON), Assimilating (ASM), Divergent (DIV) and Accommodating (ACM)

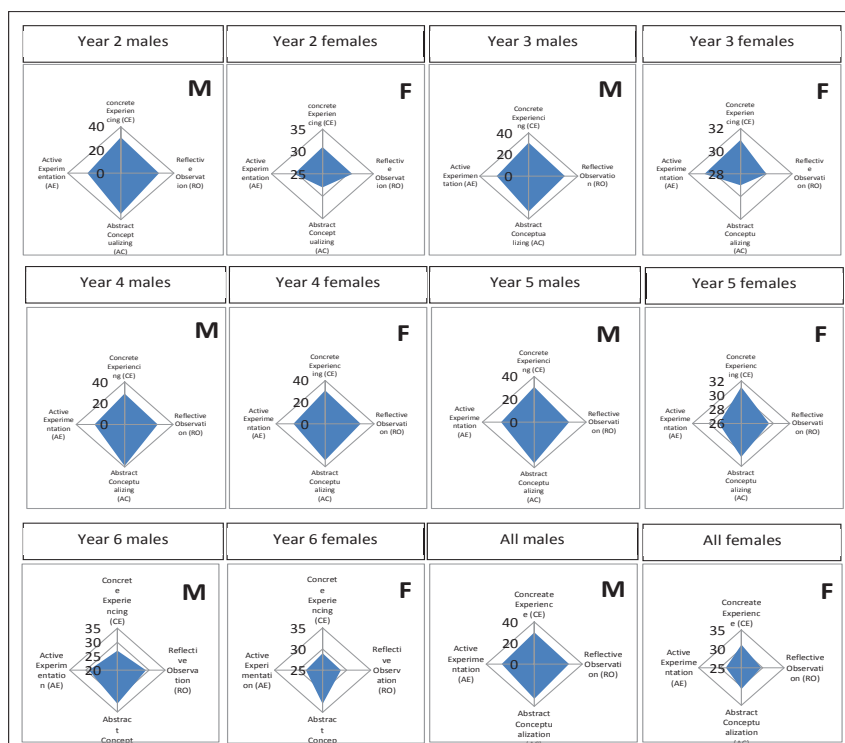


Figure 2: the mean values of the 4 dimensions; AE, RO, AC or CE for all students per gender in each academic year were estimated and plotted to produce different diamond shaped areas of learning preferences; the pattern for male students was nearly similar in all years and similar to the overall College. They had a nearly central balanced pattern. Female students' pattern was deviated towards the concrete experience or feeler styles in second and third years. The graph showed deviation to the reflective observer or reflective pattern till it became nearly balanced and concentrated in the center of the graph at graduation.

male students were more than those of female students. The reverse was evident for the assimilating and divergent styles which were more dominant in female students.

The mean values of the learning abilities; AE, RO, AC or CE for all College students were 35, 28, 30 and 26 respectively for male students while they were 31, 30, 31 and 29 re-

spectively for female students. Comparing male and female students regarding the mean values of AE-RO (6.7 vs 1.5) and AC-CE (4.1 vs 2.1), there was significant difference between them. ($t = 8.854$, $p < 0.000$ as of AE-RO; $t = 3.679$, $p < 0.001$ as of AE-RO).

4. DISCUSSION

To the knowledge of the authors, no such study was done in the Gulf region to assess a whole Medical College learning style. Medical colleges usually attract a group of the best ranked students from the scientific discipline of secondary schools. Students were enrolled in medical colleges according to the competitive ranking and interest. With the idea that medical students had the basic minimum scientific thinking suitable for medical study, the researchers aimed to assess their learning style as a part of the educational policy to determine the coping abilities of the students. A comparative study was done between male and was also done.

The pattern for male students was similar in second, third, fourth and fifth year level which were similar to the overall College male students. The outcome was nearly central balanced pattern with nearly equal sharing from all quadrants, signifying balanced learning style. Female students' pattern was deviated towards the concrete experience or feeler styles in the second and third years. The study also showed deviation to the reflective observer or reflective pattern and it became nearly balanced and concentrated in the center of the graph during graduation.

Considering that each individual has his own learning preferences, yet, this variation and change in female students cannot be clued to true different styles in different cohorts. As stated by Cuthbert, P. 2005, we cannot exclude the effect of learner past experience in affecting his response to this questionnaire items, hence affecting the results (12).

The mean values of the 4 dimensions of learning abilities; AE, RO, AC or CE for all College students per gender were presented. These values

	2 nd year		3 rd year		4 th year		5 th year		6 th year		All		All students male and female
	M	F	M	F	M	F	M	F	M	F	M	F	
AE	35	28	33	29	36	31	39	34	32	33	35	31	33
RO	29	31	30	30	27	29	27	29	29	29	28	30	29
CE	31	31	31	31	31	31	29	31	27	29	30	31	30
AC	25	31	26	31	26	29	25	26	29	28	26	29	27
AE-RO	5.6	-2.9	3.6	-1.3	9.4	1.7	11.2	4.8	3.8	4.7	6.7 T test =8.854 **	1.5	3.9
AC-CE	6.0	0.1	5.2	-0.1	5.7	2.0	4.4	5.6	-1.9	1.0	4.1 T test =3.679 **	2.1	1.7
Convergent	39	0	34	0	26	5	33	18	0	2	137(84.6%)	25(15.4%)	162(31.3%)
Assimilating	8	10	8	8	10	10	2	11	3	8	31 (39.7)	47 (60.3)	78(15%)
Divergent	14	28	19	25	5	21	5	13	33	10	76 (44)	97 (56)	173(33.4%)
Accommo- dating	0	1	0	6	20	12	19	11	20	12	63 (60%)	42 (40%)	105(20.3%)
Total	61	39	61	39	61	48	59	53	56	32	307	211	518

Table 2: The mean values of AE, RO, AC and CE and the mean differences [AE-RO and AC-CE] per academic year and in all the College and by gender were estimated

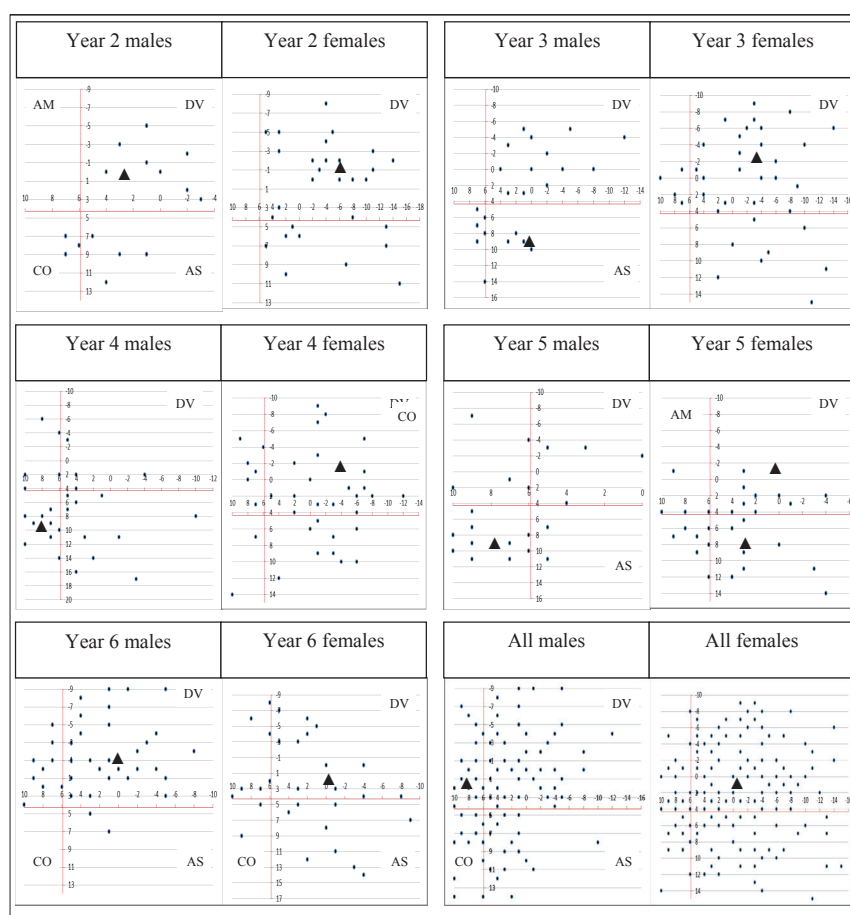


Figure 3: the difference between AE-RO and AC-CE for all students was calculated and these values were respectively plotted at the X and Y axes. Crossing of the AE-RO axis at 5.9 and AC-CE axis at 4.3 was graphed to decide the four quadrants of learning ability; convergent (CO), assimilating (AS), divergent (DV) and Accommodating (AM) learning styles. The more scattered points in any quadrant denote to the prevalence of this quadrant as a dominant learning style. The graphs are done per each academic year and in all the College and by gender. The overall mean values of these differences (AE-RO, AC-CE) were also plotted as a black triangle in figure 1, 3.

were 35, 28, 30 and 26 respectively for male students and they were 31, 30, 31 and 29 respectively for female students. The mean value of AE-RO and the AC-CE were 6.7 and 4.1 for

male students and 1.5 and 2.1 for female students.

The representations of male students in the convergent and accommodating quadrants were more than

those of female students. The reverse was evident for the assimilating and divergent styles which were more dominant in female students. The learning styles in males were convergent (CON) [137], assimilating (ASM) [31], divergent (DIV) [76] and accommodating (ACM) [63]. The learning styles in females were distributed as convergent (CON) [25], assimilating (ASM) [47], divergent (DIV) [97] and accommodating (ACM) [42]. The overall representation of learning styles in our sample was 31.3% convergent, 15% assimilating, 33.4% divergent and 20.3% accommodating.

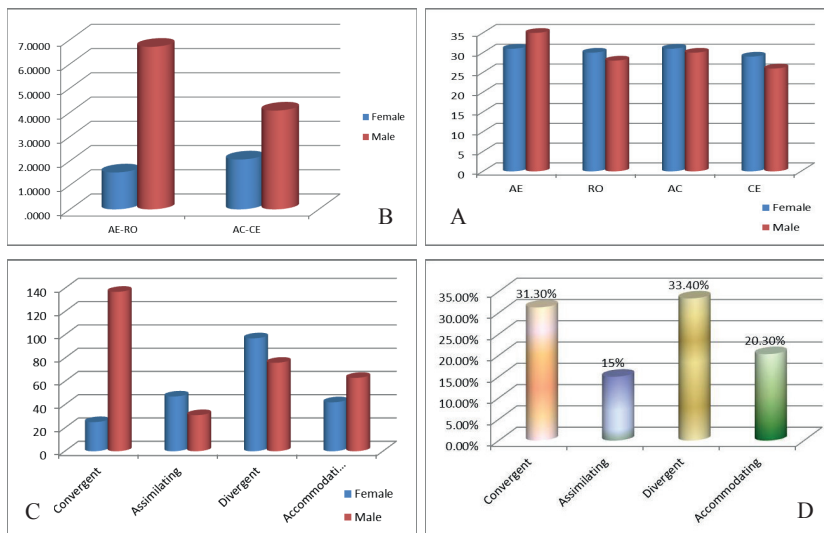
Hall (1976) proposed a cultural classification of high-context and low context cultures, based on how in each individual identity rests on total communication frameworks. Arabic countries belong to high context cultures that are associated with the CE mode; therefore, their members tend to learn through feeling in proximate contexts. (13)

This supports the finding in the female students during early college years. However, later on, all the students' male and female showed the balanced pattern without any deviation to the high or low context pattern. All the students, especially males are more exposed to different Western educational and cultural views.

The mean values of AE, RO, AC or CE were 35, 28, 30 and 26 respectively for male students and they were 31, 30, 31 and 29 respectively for female students. Female students had more tendencies towards RO and CE learning abilities.

This can be supported with shame and guilt theory. Shame process is more associated with the CE or feeler abilities. Also, guilt understanding imposes the use of internal verbal expression with more tendencies to be present in individuals with the RO or watcher abilities (14).

The findings of our study showed that the majority of convergent and accommodating learning styles were seen in male students more than females [85 % and 60% respectively] while the majority of divergent and assimilating styles were seen in female students more [60 % and 56% respectively]. These findings were



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supported by Markus and Kitayama (1991) who examined the self-construal across cultures and the interdependent-self and independent-self patterns. (15).

People with interdependent-self are likely to express their learning preference of the CE and RO abilities (Divergent Style). In contrast, the American and western European independent-self is seen as an entity that contains important characteristic attributes and as that which is separate from context. They involve the two learning abilities of AC and AE (Convergent style) with reliance upon clear concepts and distinct logic in their minds. (16).

Barmeyer's (2004) examined learning styles of 132 French, 98 German, and 123 Quebecois students and found that the learning-style distribution of French, German, Quebec students: 28.0%, 12.2%, 25.2% as of the diverging style; 34.1%, 42.9%, 38.2% as of the assimilating style; 16.7%, 32.7%, 14.6% as of the converging style; 21.2%, 12.2%, 22.0% as of the accommodating style, respectively. (17).

Kolb LSI was administered to three groups at the University of Alberta: the entire 2nd year pre-clinical undergraduate medical class (N = 157). Overall survey response rate was 73%. When examined for learning style differences, the distribution of learning styles were 6% divergent, 40% assimilating, 34% convergent and 22% accommodating. (18).

One of the studies done at Saudi

Arabia was conducted on 75 students admitted to a 4-year Bachelor of Science in Nursing degree after high school degree (conventional program or Stream I), and on 125 students admitted to a 2-year accelerated program after university degree (Stream II). The mean scores of the four learning abilities; CE, RO, AE and AC, revealed that AE was ranked the highest [Stream II (mean = 36.7) and Stream I (35.58)]; CE was ranked the lowest [Stream II (mean = 23.12) and Stream I (mean = 25.39)]. The two combination mean scores, AE-RO and AC-CE, for the overall sample and for each stream, indicated that all emphasized active experimentation over reflection and abstractness over concreteness. (19).

In this study, the males showed a learning style which is more similar to the independent-self Western group. Convergers combine abstract conceptualization with active experimentation. They apply their knowledge to examine problems and arrive at solutions in a hypothetic-deductive manner. They prefer practical application of ideas and work on technical problems. On the other hand, the female students expressed a more tendency to the interdependent-self pattern. Divergers are described as imaginative, emotional, people-oriented, and culturally interested and also view experiences from different perspectives using divergent thinking.

Despite the students are derived from the same culture, there was a difference in the dominant learning

style between male and female students. Robinson (2007) supported cultural variability among groups and cited the advantages of learning style differences. Differences may vary within cultural groups as well as between them (20).

On the contrary to these cultural differences, Zualkernan, (2006) studied participants from computer programming and engineering. He compared participants studying at an American Midwestern University in the United Arab Emirates, with students from an American background. Both groups responded to the Felder Solomen index of learning styles. The researchers showed no significant differences in learning style between both groups. (21).

Joy and Kolb (2009) aimed to examine the role that culture plays in the way individuals learn. The sample of 533 students from seven countries responded to the Kolb inventory. There was significant interaction between culture and AC-CE. There was no significant interaction between culture and AE-RO (22).

5. CONCLUSIONS

Learning style in Saudi medical students showed difference between males and females in the early college years. Most male students had convergent and accommodating learning styles, while the female dominant learning styles were divergent and assimilating. Planning and implementation of instruction need to consider these findings.

It is not enough to develop an awareness of one's learning style (for the student) and an awareness of the learning styles of a population of students (for the teacher), this awareness must be translated into a zone of comfort for learning and teaching strategies, respectively. Correlation with student performance in different curriculum parts will be our next research.

Study Limitations

This research was based on sample from our College, including about 500 students.

This study depended on self-filled questionnaire. Confounding factors as student feeling, mood and own personal perspectives may affect the

findings.

The multiple academic levels of the students may affect the way they think and answer the questions of learning style inventory because the experience gained by College education may affect the answers.

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