

# Learning Styles of Undergraduate Medical Students: Using the Kolb Learning Style Inventory

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## Abstract

**Purpose:** To identify the predominant learning styles of undergraduate medical students.

**Method:** A cross-sectional descriptive study using Kolb Learning Style Inventory Version 3.1.

**Study population:** Year 3 medical students at Faculty of Medicine and Health Sciences, UCSI University, Terengganu Campus, Malaysia.

**Results:** The response rate was 93.3% and responses from 65 students were analyzed in the study. The mean scores of learning orientations – Active Experimentation (AE), Reflective Observation (RO), Abstract Conceptualization (AC) and Concrete Experience (CE) – of all participants were 32.9, 29.6, 33.6 and 24.0, respectively and the mean score of CE was significantly lowest among all four learning orientations. When identified by four basic learning styles, those with predominant Diverging (30.8%) and Assimilating (30.8%) groups account for the largest population, followed by Accommodating (20%) and Converging (18.4%).

**Conclusion:** Year 3 medical students at UCSI University have diverse learning orientations and learning styles. As a group, the distribution of their learning styles is similar to findings in some studies among medical students but different from medical residents and specialists in total normative group and other studies. It is hoped that the findings in this study can be used in designing learning environments and teaching/learning activities as well as in providing support to facilitate students' learning.

**Keywords:** Learning styles, Kolb, Experiential learning, Malaysia

## Article

### Introduction

Depending upon how learning is defined, there are many useful definitions of learning styles. David Kolb proposed the Experiential Learning Theory (ELT) and defined learning as the process whereby knowledge is created through the transformation of experience and knowledge results from the combination of grasping and transforming experience (D. A. Kolb, 1984) and this theory can be used as a framework in interpreting and diagnosing individual learners as well as designing learning environments (Kaufman & Mann, 2014).

Kolb is the most cited author in the learning style literature (Desmedt & Valcke, 2004) and Kolb Learning Style Inventory (KLSI) is one of the most commonly administered instruments to students of health departments of universities during the last decade (Babadogan & Budakoglu, 2012).

More importantly, it is beneficial to study the learning styles of individuals because they influence educational outcomes of a programme (Rassool & Rawaf, 2008) and educators can improve the efficacy of learning by recognizing learning styles of their students (Romanelli, Bird, & Ryan, 2009).

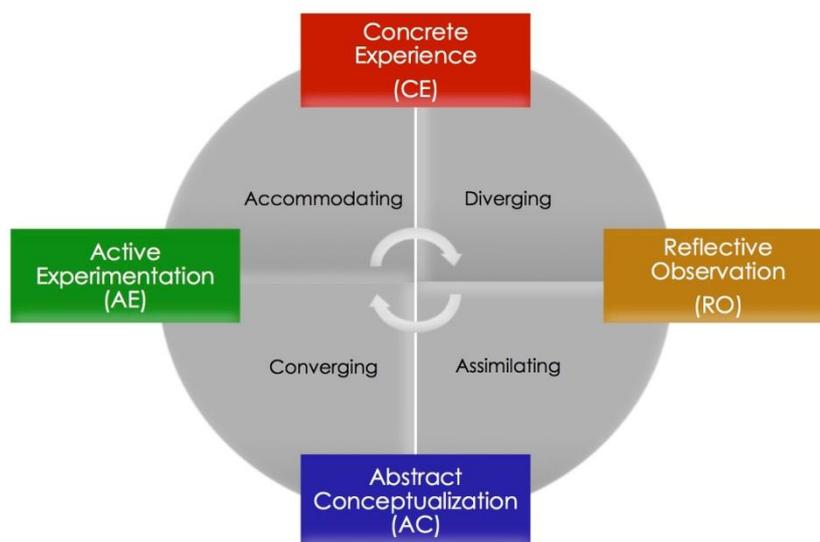
## Background

Experiential Learning Theory by David Kolb portrays two dialectically opposite orientations of grasping experience – *Abstract Conceptualization* (AC) and *Concrete Experience* (CE) - and another two dialectically opposite orientations of transforming experience – *Active Experimentation* (AE) and *Reflective Observation* (RO). Kolb describes his model by illustrating these four learning orientations in a cycle of learning where the learner touches all the bases in recursive process (Figure 1). However, it is not necessary for each person to start a learning cycle in the same mode of ability but may skip a phase, focus primarily on just one phase or begin a learning process in any of the four phases of learning cycle (D. A. Kolb, 2010).

Since these orientations of information grasping and transforming are dialectically opposite, conflicts develop when a student learns. According to Kolb, the learning style is “generalized differences in learning orientation based on the degree to which people emphasize the four modes of the learning process” (D. A. Kolb, 1984) and individual learning styles are determined by an individual’s preference for using a combination of these dialectic orientations in resolving conflicts to learn (A. Y. Kolb & Kolb, 2005a).

Initially, Kolb defined four basic learning styles - *Converging*, *Accommodating*, *Assimilating* or *Diverging* – each located in a different quadrant of the learning cycle (Figure 1). However, in the later exposition of his theory, Kolb discussed two new orders of learning styles with five and nine styles, respectively (Coffield, Moseley, Hall, & Ecclestone, 2004; A. Y. Kolb & Kolb, 2005b). The first order refers to the four basic learning styles described above. The four second order learning styles combine the abilities of two basic learning styles and the third-order learning styles are exhibited by people who have integrated the four basic styles, who learn in a holistic way, ‘using the abilities associated with all four learning modes’ (D. A. Kolb, Boyatzis, & Cainemelis, 2000).

**Figure 1:** Kolb’s Learning Cycle (Adapted from Kolb Learning Style Inventory Version 3.1 Workbook, David Kolb, Experience Based Learning Systems, Inc, 2010)



Along with ELT, Kolb designed a Learning Style Inventory (KLSI) to determine an individual’s learning preference. The first version of KLSI was developed in 1976, the second in 1985 and the third in 1999 (Coffield et al., 2004). The third version (used in this study) has been extensively tested across a different

populations and found to have a good internal consistency reliability and a moderate to excellent test-retest correlation coefficients (A. Y. Kolb & Kolb, 2005b).

Learning styles have been extensively studied among Malaysian students studying at higher education institutions. However, majority of these studies among medical students use VARK® questionnaire (Kumar, Voralu, Pani, & Sethuraman, 2009; Mon, Fatini, & Ye, 2014; Muralidhara, Simbak, Nasir, & Nor, 2013; Sinha, Bhardwaj, Singh, & Abas, 2013). We recently studied the learning styles of medical students at our institution using VARK® questionnaire to determine their sensory modality preferences of learning (Tha & Khin, 2014). Since VARK is based the instructional preference model emphasizing on the ways students best acquire information, we did this study to define the learning styles of medical students using a framework based on information grasping and processing.

## Methods

The purpose of this cross-sectional study is to define the learning orientations and predominant learning styles of undergraduate medical students by using Kolb Learning Style Inventory Version 3.1.

The study was conducted at the Faculty of Medicine and Health Sciences, UCSI University, Terengganu Campus and the study population was Year 3 medical students at the beginning of their academic year.

After receiving approval from Faculty Ethical Committee, all Year 3 students were invited to participate in the study. We explained the overview and purpose of the study, took written informed consent to participate on voluntary basis and distributed the questionnaires. The instruction for completing the questionnaire was clarified by the researcher.

The questionnaire included age and gender of the participant and Kolb Learning Style Inventory Version 3.1 (KLSI 3.1), English version from the HayGroup®, UK (D. A. Kolb, 2010). It was a 12-item questionnaire that uses a forced-choice ranking method for each item to determine a participant's learning orientations and predominant learning styles.

The form was self-administered by the participants at their convenience and collected at one week. Two persons entered the questionnaire responses to the database and each checked one another to reduce errors.

Four primary scores – AC, CE, AE and RO – that measures the participant's relative emphasis on the four learning orientations and two combination scores that evaluate preference for abstractness over concreteness (AC-CE) and action over reflection (AE-RO) are calculated by using simple arithmetic equations provided in KLSI 3.1 Workbook (D. A. Kolb, 2010).

The predominant learning styles of individual participants were defined by plotting the intersection points of AC-CE and AE-RO scores on the learning style type grid described in KLSI 3.1 Workbook (D. A. Kolb, 2010).

The data were analyzed for mean and standard deviation of learning orientations, comparison of mean scores for four learning orientations and frequency distribution of the predominant learning styles.

The statistical tests applied were t-test, one-way ANOVA test and Tukey's HSD test. We used Microsoft® Excel® for Mac 2011 (Microsoft, Redmond, WA, USA) and Predictive Analysis SoftWare® Version 18 (PASW Statistics for Mac, Version 18.0, Chicago, IL, USA) for data analysis. Significance was considered at  $p < 0.05$  in this study.

## Results

The response rate was 93.3% for the survey from potential 75 students. Five responses were excluded due to incompleteness, making a total responses analyzed to 65. The sample population was made up of 37% male and 63% female. The mean age of all participants is 22.8 years ( $SD = 0.75$ ).

### *Learning Orientations*

Table 1 shows the mean scores of four learning orientations and preference for abstractness over concreteness (AC-CE) and action over reflection (AE-RO). The mean scores of AE, RO, AC and CE of all participants were 32.9, 29.6, 33.6 and 24.0, respectively. The mean AC-CE and AE-RO are 9.6 and 3.3, respectively.

The mean AE, RO, AC, and CE scores among male students were 32.3, 30.3, 34.5 and 23.0 respectively while the mean scores among female students were 33.3, 29.1, 33.0 and 24.6 respectively. The mean AC-CE and AE-RO scores among male students are 11.5 and 2.0 while among female students are 8.5 and 4.1. There is no significant difference in each mean score of learning orientations as well as AE-RO and AC-CE between male and female students (*t-test*).

Table 1. The mean scores of four learning orientations and two combination scores among male and female students (n=65).

Gender	n	%	AE	RO	AC	CE	AC-CE	AE-RO
Male	24	37	32.3±5.3	30.3±6.4	34.5±8.4	23.0±4.8	11.5±12.3	2.0±10.1
Female	41	63	33.3±4.8	29.1±5.7	33.0±7.2	24.6±4.8	8.5±10.9	4.1±8.9
Total	65		32.9±5.0	29.6±6.0	33.6±7.6	24.0±4.8	9.6±11.3	3.3±9.3

Learning orientation scores of participants are shown in Figure 2.

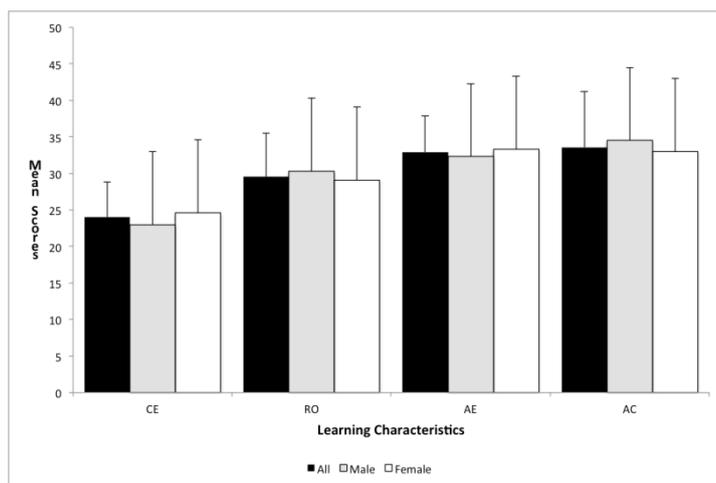


Figure 2. Learning orientation scores of participants.

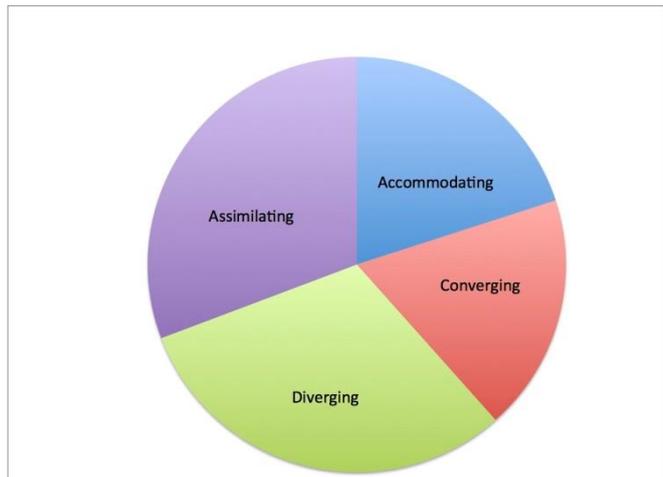
Among all participants, there is a statistically significant difference among four learning orientations scores ( $p < 0.001$ ; One-way ANOVA). The mean CE score was significantly lowest among all four learning orientations ( $p < 0.001$ ). The mean RO score is significantly lower than that of AE ( $p = 0.009$ ) and AC ( $p < 0.01$ ) but there is no significant difference between AC and AE (Tukey's HSD test).

The difference of these four learning orientations is also significant among male students ( $p < 0.001$ , One-way ANOVA). CE score is significantly lowest among four ( $p < 0.001$ ). However, significant difference is not seen among other three scores AE vs. RO, AE vs. AC, and RO vs. AC (Tukey's HSD Test).

Among female students, similar to male students, there is a statistically significant difference among these four learning orientations ( $p < 0.001$ , One-way ANOVA). CE is the significantly lowest mean score ( $p < 0.002$ ). Mean RO score is significantly lower than that of AE ( $p < 0.007$ ) and AC ( $p < 0.011$ ) but there is no significant difference between AE and AC (Tukey's HSD Test).

### Learning Styles

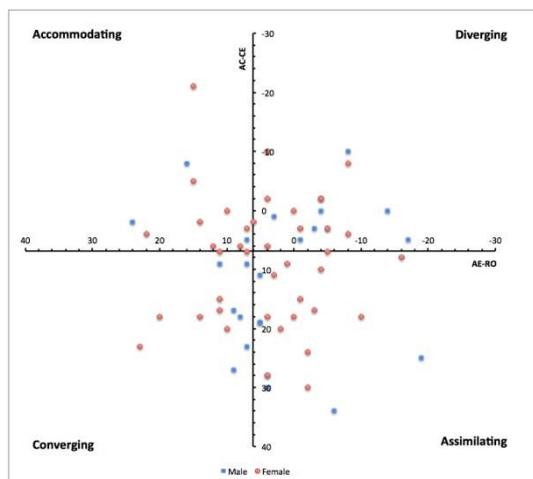
Figure 3 shows the distribution of students by their predominant learning styles.



**Figure 3.** Distribution of students by predominant learning style

When students are defined by four basic learning styles, Assimilating and Diverging styles account for the largest groups of study population (n=20; 30.8% each), followed by Accommodating (n=13; 20%) and Converging (n=12; 18.4 %) styles.

Figure 4 shows the distribution of intersections of AE-RO and AC-CE of all participants plotted on the learning style grid. The intersection of mean points 9.6 (AC-CE) and 3.3 (AE-RO) of all participants, which indicates the learning style of the study population as a whole, is located in the assimilating style quadrant.



**Figure 4.** Distribution of intersection of AE-RO and AC-CE of participants plotted on learning style grid. (Used with permission from HayGroup®, UK.)

### Discussion

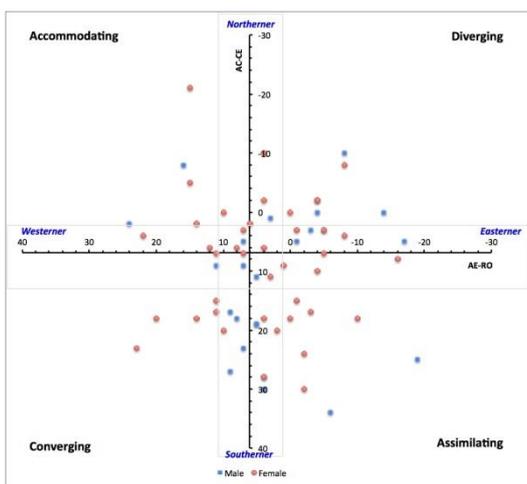
We did not expect any difficulty for students to respond this English version of the Inventory as it is geared to a seventh grade reading level and intended for use by teens and adults (A. Y. Kolb & Kolb, 2005b). All participants in this study have fulfilled the entry requirement of English language for the medical programme of the University (GCEO Level English – B3, TOEFL - 550 (paper-based) or 79-80 (internet-based), or IELTS – Band 6). The medium of instruction at the University is English.

Our study shows that the mean CE (Concrete Experience) score of the participants is significantly lowest among all four learning orientations among male as well as female students. Although it is not necessary for a learner to start a learning cycle in the same mode of ability, immediate concrete experience notionally locates the starting point of learning in the experiential world (D. A. Kolb, 1984). In fact, many teaching/learning activities in medical education, such as lecture examples, problem sets, readings, simulations, laboratories, observations and field works, are to accommodate concrete experience process (Hawk & Shah, 2007). We are concerned if these students engage to day-to-day teaching/learning activities at our situation.

When students in our study are defined by four basic learning styles, those with converging style are the smallest proportion (18.4%) while diverging and assimilating styles make the largest population (30.8%). When compared to the findings of other researchers in various part of the world, there are findings of medical students with diverging and/or assimilating group making the largest population (Bitran et al., 2012; Chung et al., 2009; Engels & de Gara, 2010; Gurpinar, Alimoglu, Mamakli, & Aktekin, 2010), and converging group making the smallest (Kim & Roh, 2007).

However, among residents of various medical specialties (A. Y. Kolb & Kolb, 2005b; Laeeq et al., 2009; Mammen et al., 2007; Tuli et al., 2011), converging style individuals are the largest population. Similarly, the mean scores on AC-CE and AE-RO of the our study population, when it is plotted on the learning style grid, locates in the assimilating quadrant while those respondents in the total normative group with specialization in medicine is in the converging quadrant (A. Y. Kolb & Kolb, 2005b). It is probably because the participants in our study are in the middle of their programme and have not reached their discipline specific norm. In a study by Nulty and Barrett (1996), it is found that the learning styles of students tend to their specific discipline norms in the final third of their studies and Gurpinar, Bati and Tetik (2011), in their longitudinal study, found that the learning styles of medical students might change over time irrespective of curriculum model or other independent variables. Based on these findings, we could do the same study on the same students when they reach the last part of their programme to determine if they change their learning styles to discipline norms, i.e., converging style, in other studies.

Unfortunately, despite our analysis to define study population by second- and third-order learning styles, we could not discuss further because of the scarcity of exploratory research using these orders and small sample size in our study. In fact, many students are using a combination of two basic styles and some using the balancing style (Figure 5).



**Figure 5.** Distribution of intersection of AE-RO and AC-CE of participants plotted on learning style grid. (Adapted from A. Y. Kolb and Kolb (2005b)).

Although this is a simple descriptive study, it is hoped that findings on the predominant learning styles of individual students in this study are useful to help them recognize their own learning strengths and weaknesses. It is useful to stimulate conscious efforts of the students in developing new potential for learning

so that they enhance their learning experiences because there are ways described to strengthen and develop each learning style for an individual students (D. A. Kolb, 2010). It is not to rely too heavily on one learning style as it may lead to miss out important idea and experiences, but to use different styles at different learning environments. In fact, learning is enhanced if students are encouraged to use all four learning styles and so, education programme planners and teachers need to provide all four learning environments, namely affectively oriented (feeling), symbolically oriented (thinking), perceptually (watching) and behaviourally oriented (doing) environments, that are most conducive for accommodating different learning styles and learning orientations (Fry & Kolb, 1979; Kaufman & Mann, 2014).

There are limitations in our study. First, some of the participants are students who joined the programme did their first two years of study at various medical schools in other countries. This may also have influence on the results of the study. Secondly, because of the scarcity of studies using KLSI among Malaysian medical students, we could not do any comparison with students from other medical schools in Malaysia, and because of the small sample size, findings in this study cannot be generalized to all Malaysian medical students in the country.

In future, (a) a longitudinal study on the learning styles of the same cohort of medical students should be done when they are in the final year of the programme to determine if their predominant learning styles change to disciplinary norms, and (b) a larger study should be done to compare the learning styles of medical in the earlier parts of their studies and those in the later parts to see if there is any significant difference in distribution of learning styles among different cohorts.

## Conclusion

Medical students at UCSI University have diverse learning orientations with the mean score of Concrete Experience significantly lowest among all four learning orientations. The distribution of their learning styles also diverse with Diverging and Assimilating styles making the largest groups while Converging style the smallest group.

Although this is a descriptive study with small sample size, it is hoped that the knowledge on the learning styles has practical implications for programme planners, medical teachers as well as learners. We recommend that the faculty take into consideration the learning orientations and the learning styles of its medical students in designing learning environments and teaching/learning activities to maximize their learning potential. On the other hand, individual students are encouraged to recognize their predominant learning style because, as suggested in KLSI workbook, they can develop and strengthen each learning style, especially a weaker one.

## Acknowledgement

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## Conflict of Interest

None.

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