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Research Paper: Learning Styles and Toxicology Knowledge of Medical Students of Mashhad University of Medical Sciences

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ABSTRACT

Background: Considering the breadth of medical knowledge, it is very important to study medical students' learning and ways to facilitate it. One of the key areas in learning is studying methods. This study aimed to determine the preferred learning style in medical students and the level of learning in a medical discipline (Toxicology) as well as its correlates.

Methods: Thirty-seven medical students who were admitted to an internship course, completed a questionnaire about their preferred learning style using the VARK (Visual, Auditory, Read/Write and Kinesthetic) method. Then, a standardized test was applied to measure the students' score for each level of learning and the total score of learning.

Results: The study participants included 20 males and 17 females. The preferred style of learning was mostly (32%) aural. Thirteen (35%) students preferred single-style of learning, and 24 (65%) preferred more than one style. No significant relationship was found between the learning style and the score on each learning level. No significant relationship was found between the preferred learning style and the total score of the final test (P>0.05). There was also no significant difference between persons with regard to single style and multiple styles of learning (P=0.46). The scores of theoretical knowledge was higher than the practical knowledge in all styles and among those with a multiple style of learning.

Conclusion: Learning style is just one of the effective factors in medical education and it has no significant relationship with the level of learning. The current training method in some areas (toxicology training) for medical students, is more successful in transferring knowledge than skills to apply that knowledge.

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1. Introduction

Medical education is among the main challenges of medical universities, all over the world. Medical education is a long-term study of extensive medical contents continued with lots of internship hours [1]. Also, in most other sources as well Learning to be relatively stable. Be defined in behavior which is the result of practice or Learning has been obtained. Earn knowledge and information and learning actions too another definition for learning [2]. The emotional sphere includes goals that change in accordance with interests, and reflects individual's attitude and values. Psychomotor field refers to motor or physical skills.

Bloom et al. divided cognitive objectives into 6 categories: 1. Knowledge: Replication of the previously learned answers in situations like naming or defining; 2. Comprehension: Perception of intent or purpose, make a story or make sense of a connection, like translation, summarizing or expressing similarities and differences; 3. Application: Refers to the ability to use principles, rules, and laws in practical situations like problem solving; 4. Analysis: This includes identification of the important parts or reasoning; 5. Evaluation and criticizing; and 6. Creation: To create a new structure [3, 4].

Learning is a process comprising readiness, motivation, purpose, past experiences, situation and learning environment, teaching method, the whole and the relationship, practice and repetition, the learning style, type of thinking, and so on [5, 6]. This study aimed to determine the preferred learning style in a number of medical students. Then, the level of learning in a branch of medical knowledge (Toxicology) was assessed. Finally, the relationship between learning styles and the level of learning were examined. This study aimed to explore the most prevalent learning style in medical students. Also, we investigated the level of learning among students with different learning styles.

2. Materials and Methods

A total of 4 interns attended a 15-day toxicology course. All participants provided a consent form. Individuals' preferred learning styles were determined at the beginning of each 15-day period by VARK (Visual, Auditory, Read/Write and Kinesthetic) questionnaire. The course of toxicology training included a combination of the attending lectures, patients' visits, touring the exhibitions (Museum of Toxicology) and morning reports (4 sessions per course). The interns were evaluated at the end of the course.

Four questions for each 5 educational objectives were designed in different levels of learning (The validity of the questionnaire was approved by content validity method, and its reliability was confirmed by the Test-Retest method). Ultimately, the total score and each score level as a profile of the best level of learning (in the cognitive field) were evaluated. The data collection continued for 6 months. The obtained data were analyzed with descriptive statistics and inferential statistics (Chi-Square test, Fisher's Exact test) in SPSS V. 18. The minimum sample size was calculated using the Cohen's formula as 37 interns.

VARK

Learning styles include visual styles, listening, reading, writing, and kinesthetic learning.

Visual style

People with a visual style, prefer diagrams and the like to acquire the information. This style is also called graphic style.

Aural style

People with this style, prefer listening, i.e. listening to the radio or to lectures. They speak aloud to learn and acquire new information.

Reading/ Writing style

These people prefer reading and writing to learn and benefit from Power Point and websites like Google and Wikipedia.

Kinesthetic style

These people prefer to practice and experience, see samples or simulations or videos, etc. for better learning [7].

Restrictions

Sometimes attracting students' collaboration to participate in research projects encounter problems.

3. Results

The total number of the study subjects were 37 students, of those, 20 (54%) were males and 17 (46%) females. They were 26 to 27 years old. Most students had a multi-style approach of preferences (65% vs.

Frequency	13	18	6	0
Percent	35.1	48.6	16.2	0

Figure 1. Frequency of learning styles in medical students

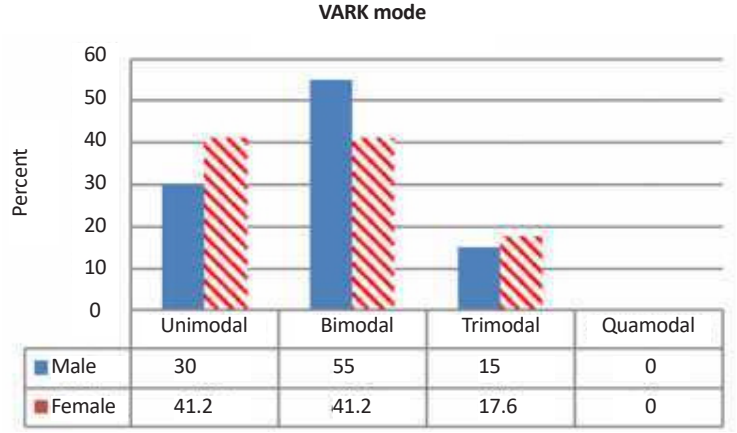
35%). Figure 1 shows the frequency of different learning styles in participants. Bimodal learning style was the most frequent style. Of all 13 people with unimodal learning style, 8 (61.5%) preferred the reading/writing learning style. The frequency of the two modes by gender is shown in (Figure 2). A total of 12 (32%) individuals preferred the aural style.

Comparing the frequency of learning styles (unimodal vs. multimodal) showed no significant differences between sexes (P=0.48). Comparison of mean scores of different learning styles in two genders are presented in Table 1. There was no significant correlation between the student's final score and scores derived from each learning style domain (P>0.05). There was no significant difference in the final score of the students between the two groups (unimodal vs. multimodal learning style) (P>0.2). Also, there was no significant difference between learning styles and the level of their toxicology knowledge. Most subjects preferred aural and multimodal learning styles.

4. Discussion

Based on the results, there is no significant differences between the genders with regard to the learning style preferences. Thirteen (35%) students preferred single style, and 24 (65%) preferred the multiple style of learning. There was no significant correlation between the preferred learning style and total score of the test or student's score at each level of learning. Also, there was no statistically significant difference in the final score of the test between people with single style and multi-style learning. There is no consensus among studies available on the learning styles in medical students. The study results of Narges Zamani et al. are consistent with the present study results [5, 6].

Also, the aural style was dominant in some studies, while the results of other studies were different. For example, the visual style was the most prevalent learning style in the study of Narjis Amini et al. In the study of Ali Hejazi and several others, the prevailing learning style in medical students was kinesthetic learning [7, 8]. Moreover in most investigations, multi-style preference was more frequent than the single style, that is consistent with the present study. In the forthcoming study, the prevalence of listening style is the most common, But it is very close to multi style that is, those who use 2 or more of the style, To prioritize learning.



Male	30	55	15	0
Female	41.2	41.2	17.6	0

Figure 2. Frequency of different modes by gender in medical students

Table 1. Comparison of mean scores of different learning styles between two genders

VARK Types	Mean±SD		P
	Male	Female	
Visual	4.45±3.94	4.18±3.47	0.97*
Aural	5.90±3.16	6.18±2.96	0.56**
Read/write	5.25±3.63	5.35±3.48	0.93*
Kinesthetic	3.75±2.92	3.82±3.47	0.89*

*Mann-Whitney test; **Independent Sample t test

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Age, educational level and even different topics of learning seem to influence the preferred style of learning, especially among the medical students. Therefore, determining the preferred learning style in medical students could be helpful in the training process. But it looks like that a preferred style has a dynamic subject even in one person, and is a function of other factors. Therefore, it will not be the sole and most important factor for educational planning and further studies are needed to examine this important subject. Although many researchers consider determining preferred learning style in medical students a very important and decisive issue, other researchers believe that people may choose a different learning style in different situations and on different subjects. Different results are obtained from numerous studies on students at different levels and various medical and paramedical disciplines about the preferred style of learning [9, 10].

Thus, it is necessary to provide medical education through various methods so that people with different preferences benefit from it, under every circumstance. According to our results, the score of the level of theoretical knowledge was the highest in all groups of preferred learning styles and the score of the level of practical knowledge was the lowest. Therefore, the 15-day period of toxicology, which provided a combined method of theory training, simulations, and patient's visit, was successful in transferring knowledge to the students, but weak in improving the use of informational skills. Prior research emphasizes on the necessary capabilities for the correct patient management, in addition to transferring knowledge in medical education [11].

Interns have many subjects in their minds and understand them, even have the power to interpret and analyze the obtained data, but they are weak in applying their knowledge. Various research studies have been conducted globally to promote education, learning methods and learning levels to achieve clinical educational goals [12].

The impact of different educational methods on different cognitive skills and students' attitudes have been studied by various methods. Most of these studies reported the effectiveness of the training, investigating, skills development and clinical independence, as well as the application of knowledge [13].

The current teaching methods seem to be far from ideals. The present study on training the clinical toxicology, demonstrates a success in knowledge transfer but a failure in decision making skills and creating the power to apply the information. Not much of a success has been gained to enhance the level of learning in medical students so far. Numerous studies have applied various methods to reform the educational environment, set new goals, as well as new teaching strategies and methods. In addition to modification and promotion of evaluation methods, various steps are also taken to facilitate learning, using modern educational technologies, different psychological studies and even comparative studies to find the best ways to educate medical students. Research studies on the adequacy and teaching toxicology knowledge are also presented [14-17]. However, further studies are needed at least in some disciplines of medical education, to train a physician with proper knowledge and skills and enough independency in decision making.

5. Conclusion

Overall, determining the preferred learning style seems to improve the quality of medical education. However, our combined method of training in the Clinical Toxicology Ward of Imam Reza Hospital, Mashhad succeeded to transfer the information at the level of knowledge, understanding, and even analysis. Future studies are recommended to explore other effective factors on improvement and facilitation of learning. It is also suggested to develop procedures and methods that upgrade the level of medical students' learning from the level of acquiring knowledge to using that knowledge.

Ethical Considerations

Compliance with ethical guidelines

Ethical approval was obtained from the Department of Toxicology, Mashhad University of Medical Sciences, Mashhad, Iran.

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Conflict of interest

The authors certify that they have no affiliation with or involvement in any organization or entity with any financial interest, or non-financial interest in the subject matter or materials dismissed in this manuscript. All authors were involved in the study design and data collection, interpretation of the results, and editing the intellectual content. All authors approved the final version of the manuscript.

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