

Towards Better Understanding of Medical Students: Learning Styles of Preclinical and Clinical Medical Students

Marwa M. Khalil¹, Mohamed Galal Al Din Ahmed², Shefaa M. Gawish²

Abstract

Introduction: Medical students represent a broad spectrum of diversity that presents a challenge for instructors to meet their educational needs. Four sensory modalities of learning have been described: visual, auditory, read-write, and kinaesthetic (VARK). In order to strengthen students' non preferred learning styles, their preferred styles must be identified. This study aims at understanding the learning styles of medical students in order to develop appropriate learning approaches.

Materials and methods: The English version of the VARK questionnaire was distributed to preclinical and clinical students. Students were classified into Uni-, Bi-, Tri- or Quadri-modal.

Results: There were statistically significant differences between preclinical and clinical students in the means of different VARK styles. The Quadri-modal preference (VARK) was the most preferred followed by Kinaesthetic. The most common in bimodal was Auditory-Kinaesthetic while in tri-modal Auditory-Read-Kinaesthetic and Visual-Auditory-Kinaesthetic. There were statistically significant differences between Preclinical and Clinical students in (Visual-Read) preference and (Auditory-Read-Kinaesthetic) and (Visual-Auditory-Kinaesthetic) preferences.

Conclusion: A hypothesis that medical students had higher preference for Kinaesthetic learning compared to average students, was confirmed in this study. Further studies are recommended to investigate the correlation between different learning styles and performance of students in different types of exams.

Key words: VARK questionnaire

Introduction

The term "learning styles," as used in the literature during the past 30 years or so, has labelled a very broad and relatively diffuse concept (Bedford, 2006). A learning style or preference is the complex manner in which, and conditions under which, learners most efficiently and most effectively perceive, process, store, and recall what they are attempting to learn (James & Gardner, 1995).

One characterization of learning styles is to define the learners' preferred mode of learning in terms of the sensory modality by which they prefer to take in new information (Lujan & DiCarlo, 2006).

Today's medical students represent a broad spectrum in terms of age, experience, culture, ethnicity, and level of preparedness as well as learning preferences and styles. This diversity is welcomed; however, it also presents a challenge for instructors to meet the educational needs of all students. Specifically, student motivation and performance improves when instruction is adapted to student learning preferences and styles (Lujan & DiCarlo, 2006). Thus, it is the responsibility of the instructor to address this diversity of learning styles among students and develop appropriate learning approaches (Tanner & Allen, 2004).

¹Public Health and Community Medicine Department, Faculty of Medicine, Zagazig University, Zagazig, Egypt

²Professor, Dubai Medical College, Dubai, UAE

Corresponding author:

Dr. Marwa Khalil,

P.O. Box 441103 Dubai, UAE

Email: mdaso4@hotmail.com

Fleming and Miles, (1992) defined four sensory modalities of learning: visual, auditory, read-write, and kinaesthetic. Visual learners prefer the use of diagrams and symbolic devices such as graphs, flow charts, hierarchies, models, and arrows that represent printed information (Chan *et al.*, 1991; DiCarlo *et al.*, 1998; Rodenbaugh, 1999). Read-write learners prefer printed words and texts as a means of information intake; they also prefer lists, glossaries, textbooks, lecture notes, or hand-outs. Auditory learners prefer “heard” information and, thus, enjoy discussions, lectures, and tutorials when acquiring new information (Rao & DiCarlo, 2000; Cortright 2005). Kinaesthetic learning is a multimodal measurement employing a combination of sensory functions. Kinaesthetic learners have to feel or live the experience to learn; they prefer simulations of real practices and experiences, field trips, exhibits, samples, photographs, case studies, “real-life examples,” role-plays (Kuipers & Clemens, 1998), and applications to help them understand principles and advanced concepts.

Some learners have a preference for a single learning modality, whereas multimodal learners do not have a strong preference for any single method. They rather learn via two or more of the modalities (Zeynep & Melis, 2007).

Previous investigators have suggested that students from specific professional groups have particular learning style preferences, and that learning styles have an impact on academic success and student performance during the completion of clinical field work education placements (Cavanagh & Coffin, 1999). In order to direct to strengthen students' non preferred learning styles, their preferred learning styles must be identified (Brown *et al.*, 2008).

Aim of the study

This study aimed to understand the learning styles of preclinical and clinical medical students in Dubai Medical College to help improve their performance and to develop appropriate learning approaches.

Materials and Methods

- **Setting:** This study was performed in Dubai Medical College in the beginning of the Academic year 2007-2008.

- **Subjects:** All first and second years preclinical students and fourth year clinical students in Dubai Medical College for Girls were included in this study.
- **Tools:** The English version of the visual, auditory, reading/writing, kinaesthetic (VARK) questionnaire and its instructions were distributed to the students. The VARK survey instrument was selected because it is concise and quick to complete and it provides useful information about the students' learning preferences. The English version of the VARK-questionnaire contains 16 multiple choice questions with four possible answers. Each possibility represents one of the four modes of perception 1) **Visual/graphic style** (prefers to take in information through the eyes) 2) **Auditory** (prefers to take in information through their ears) 3) **Read/write** (takes in information through their eyes, but as written words/language in texts) and 4) **Kinaesthetic** (prefers to take in information through the body senses by touching, manipulating, moving etc.). However, one can select more than one answer to each question, which is necessary for the identification of poly modal modes of perception and learning.
- **Statistical Analysis:** The total number of responses selected on each questionnaire was calculated. Students were classified into uni-, bi-, tri- or quadri-modal, according to the advice to users of the questionnaire produced by Fleming and Bonwell (2009) and the results were analysed using SPSS 17. The independent sample t test was used to compare the means of quantitative data.

Results

The VARK questionnaire was administered to 176 students who are the First, Second and Fourth year students in Dubai Medical College. A total of 133 students returned the questionnaire; 47 were first year students, 44 were second year students and 42 were fourth year clinical students; the response rate was 75%. The mean age of the preclinical students was 17.5 ± 0.9 years while the mean age of the clinical students was 20.4 ± 0.6 years. The Minimum, Maximum, Mean and Standard Deviation of number of responses of Dubai Medical College students to VARK Questionnaire are shown in Table 1.

Table 1: The Minimum, Maximum, Mean and Standard Deviation of DMC students' scores in each category of the VARK Questionnaire

	Minimum	Maximum	Mean	Std. Deviation
Visual scores	0	15	6.2	3.3
Auditory scores	0	15	6.7	3.1
Read/Write scores	1	15	5.8	2.9
Kinaesthetic scores	1	15	7.2	3.1

The independent samples t-test for equality of means analysis showed that there was a statistical significant difference between

preclinical and clinical students in the mean of different VARK learning styles (Table 2).

Table 2: Difference between preclinical and clinical students in the means of different VARK learning styles

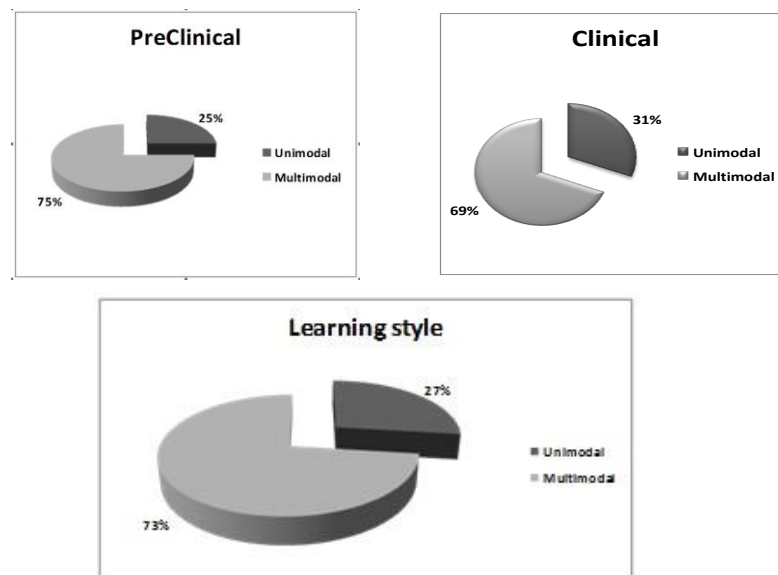
Profile	Preclinical students	Clinical students	t, P*
	Mean ± S.D.	Mean ± S.D.	
Visual	6.8± 3.5	4.7± 2.6	t= 3.5, P < 0.05
Aural	7.3±3.3	5.4± 2.4	t= 3.3, P < 0.05
Read/Write	6.3± 2.7	4.5± 2.9	t= 3.5, P < 0.05
Kinaesthetic	7.8± 3.2	5.8± 2.1	t= 3.8, P < 0.05

* P < 0.05 = Significant difference

Scores for each individual respondent were evaluated for dominant or multimodal preference. The overall VARK profile of Dubai Medical College (DMC) students is shown in Figure 1, the quadri-modal learning preference (VARK) was the most preferred model in 23.3% of the students, followed by the uni-

modal Kinaesthetic style. The Multimodal learning style was the preferred learning style in DMC students. It was preferred by 73% of all the students. As shown in Figure 1, the Preclinical students had more preference to the multimodality more than the clinical students (75% and 69% respectively).

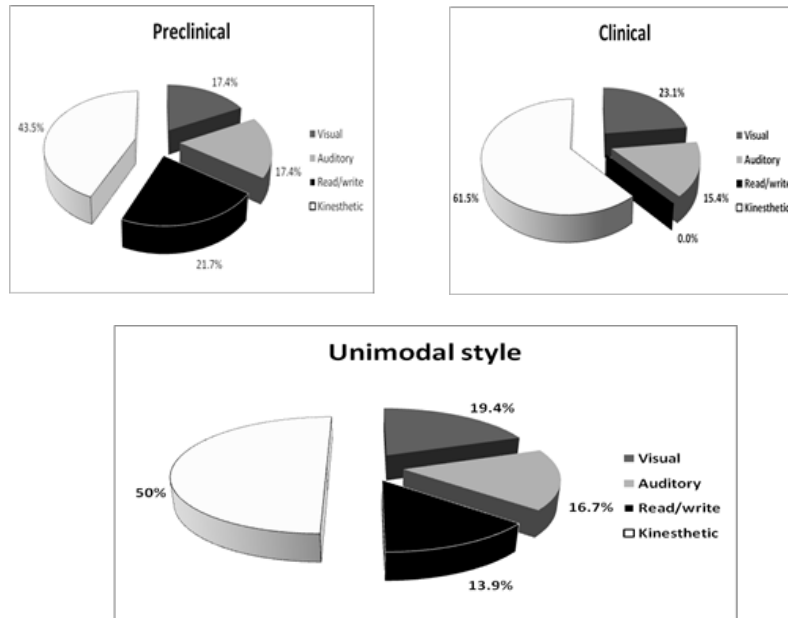
Figure 1: The prevalence of Multimodality preference in learning styles of DMC students



In those students who had a Uni-modal learning style preference the kinaesthetic style was the most prominent preference (50%), followed by the Visual, Auditory and finally Read/Write. In Preclinical students,

Read/Write preference comes as the next preference after the kinaesthetic but this preference had completely disappeared in the Clinical students as shown in Figure 2.

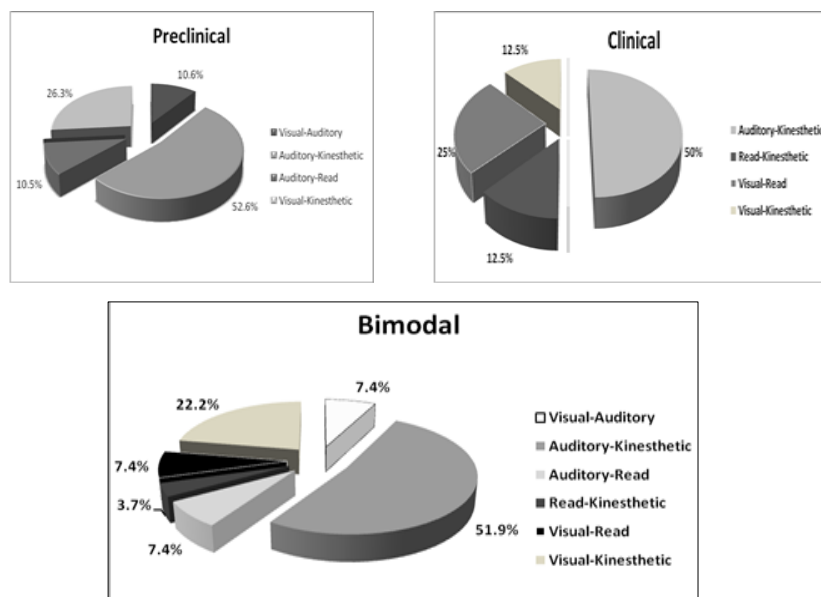
Figure 2: Preferred unimodal learning styles in DMC students



The bimodal preference with its different combinations represented 20.3% of the learning preferences in DMC students. The most common combinations was the Aural-kinaesthetic style (51.9%) this was followed by the Visual-Kinaesthetic in preclinical students and by the Visual-Read in the clinical students

as shown in figure 3. There was no statistical significant difference between the Preclinical and Clinical students in the different combinations of the Bi-modal preference except for the Visual-Read combination where there was a statistical significant difference between the two groups.

Figure 3: Preferred combinations of Bimodal learning styles in DMC medical students

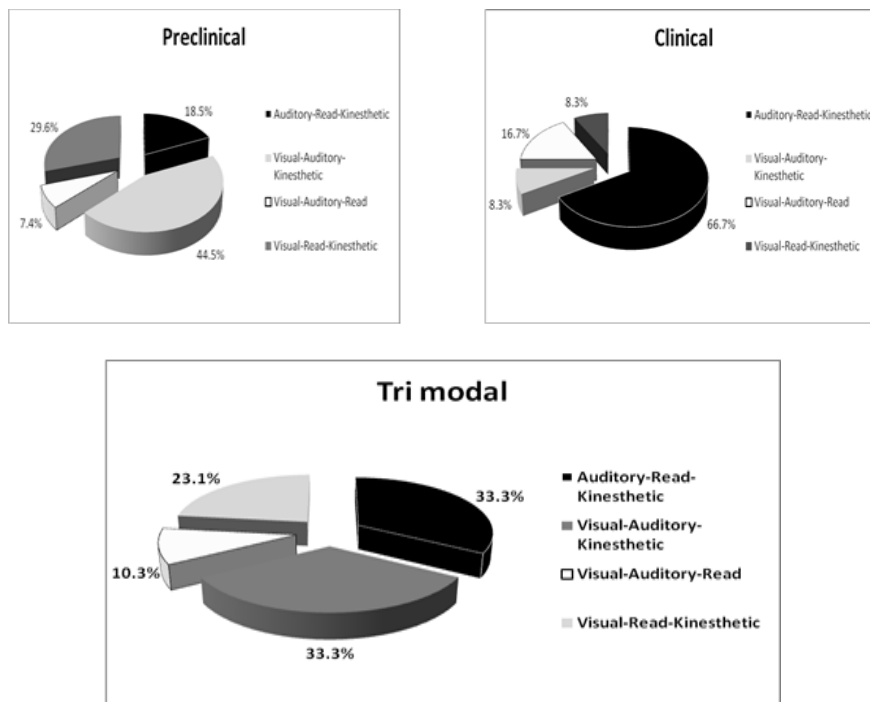


The different combinations of the tri-modal style was preferred in 29.3% of the students, with the Auditory-Read-kinaesthetic and the Visual-Auditory-kinaesthetic styles presenting more than half of those students. In preclinical students the most preferred styles were the Visual-Auditory-kinaesthetic followed by Visual-Read-kinaesthetic; while in clinical students the most preferred styles were Auditory-Read-kinaesthetic followed by Visual-Auditory-Read (Figure 4). There was a

statistical significant difference between the Preclinical and Clinical students in the Auditory-Read-kinaesthetic and Visual-Auditory-kinaesthetic tri-modal combinations.

Although there was no statistical significant difference between the students in their Uni-modal style, it was found that the Auditory style had completely disappeared in Second year preclinical students while in Forth year Clinical students the Read/Write Uni-modal style had completely disappeared.

Figure 4: Preferred combinations of tri-modal learning styles in DMC medical students



Discussion

Knowing the learning style of students is a valuable skill in education. Knowledge of learning styles may help educators identify and solve learning problems among students, thus helping their students to become more effective learners (Fleming & Miles, 1992).

Active learning strategies reach all types of learners in the visual, auditory, reading/writing, and kinaesthetic schemes. In contrast, the traditional lecture format assumes that all students are auditory learners. In addition, the traditional lecture format assumes that all students acquire the same information presented orally at the same pace without dialogue with the presenter.

The VARK questionnaire is not intended to 'box' respondents into a mind-set that they have been 'diagnosed'. Rather, it is designed to initiate a discussion about and reflection upon learning preferences. It is not expected that any one preference will be dominant or that all participants will be multimodal (Fleming & Bonwell, 2007). According to the total number of responses, individuals will be first classified as having 'Very strong', 'Strong' or 'Mild' preference towards certain learning preferences and then the other scores (for V, A, R, or K) that differ from that preference by an amount greater than (or equal to) the number indicated in the "Mild Preference" will be eliminated (Fleming & Bonwell, 2007).

Data from previous research suggests that there may be certain learning style profiles for

premedical and other pre-health professions' students (Breckler *et al.*, 2009). The profile of medical students in DMC is containing 15 different subscales, with the kinaesthetic profile (in its uni, bi, tri or quad-modal forms) representing 79% of all DMC students. Comparing this percentage with the general

population doing the questionnaire on the VARK web site as per the September, 2008 database (Fleming, 2008) Table 3 supports the idea that medical students distinguish themselves from the general population by preferring more kinaesthetic learning style.

Table 3: Kinaesthetic versus other preferred learning styles in medical students compared to the general population

	Kinaesthetic preference	Other preferences	X², P
Medical students	105 (79%)	28 (21%)	X ² =5.164
VARK web site	41849 (70%)	18020 (30%)	P < 0.05

Dubai Medical College is a girls' only medical college and previous studies have revealed gender differences in preferred methods of information delivery and suggested that the female student population is more diverse than the male population, encompassing a broader range of sensory modality preferences (Slater *et al.*, 2007). This was proved in our study as the Multimodal style was the preferred style in all study years in medical students in Dubai Medical College. This style was preferred by 75% of preclinical students and 69% of clinical students. These findings were similar to previous research studies on female medical students. Wehrwein *et al.*, 2007 found that 45.8% of undergraduate female students attending a Physiology course in Michigan University preferred a multi modal style of information presentation. Also, Erkus *et al.*, 2006 found that 46.8% of medical students in their first 3 years prefer multi-modal style. It is possible that multi-modal learners have stronger learning outcomes that better qualify them for admission to medical schools or it may be that medical schools admission policies unintentionally select for multimodal learners.

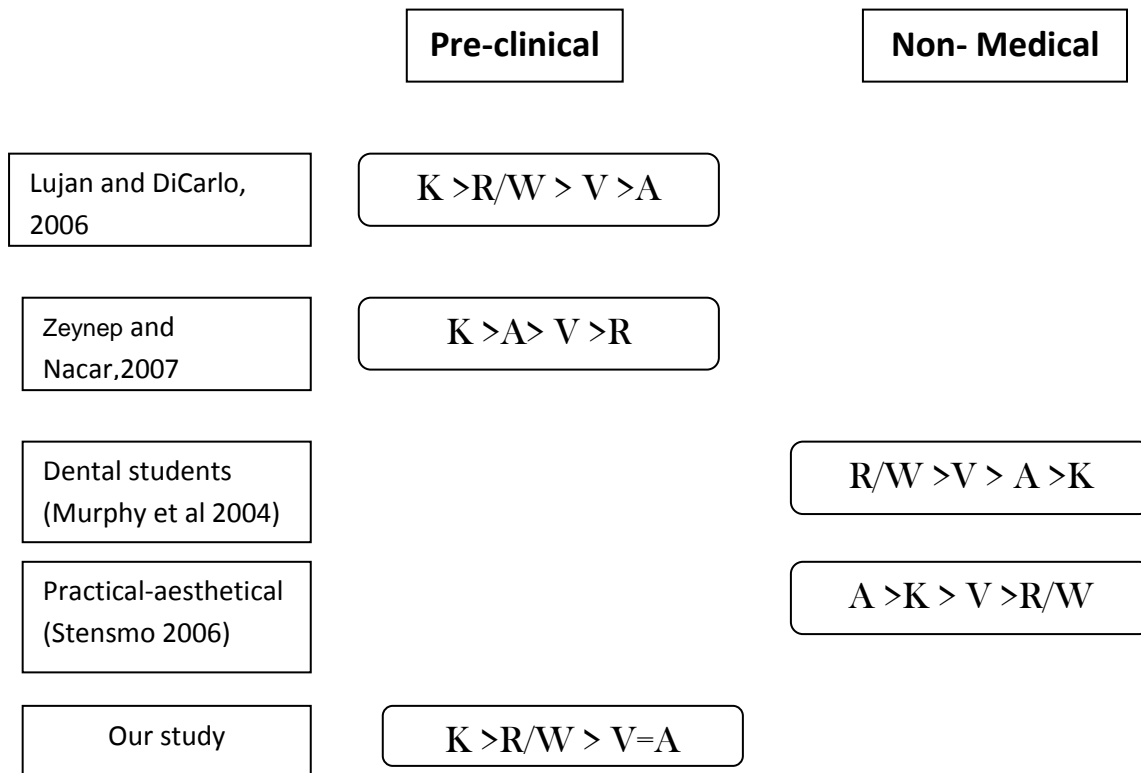
Regular academic teaching is based on lecturing and discussion, reading and writing. Academic teachers are expected to be good in such skills and are selected for their offices by the quality of their writing of papers, articles and books. However studying Medicine is an

exception; medical students prefer learning by doing and practicing, and not by reading and writing. Read/write learners were originally described as enjoying hands-on projects. This they had in common with kinaesthetic learners. The program delivery methods at the Dubai Medical College depends on different interactive teaching methods in the form of Practical lessons, Brain storming, Case Based Learning, Problem Based Learning and introduction to Clinical Skills. These methods are applied from First year and these methods may be the trigger which forced some of the students to use the multimodal style. Table 4 shows the comparison of Multi modal preferences in Premedical and non-premedical students and between males and females that was proved by our study.

In those students who prefer to learn through uni-modal learning styles, the kinaesthetic learning style was the most preferred one in both the preclinical and clinical phases. However, as the opposite of kinaesthetic, perhaps strong read-write learners like to learn in a vacuum. They do not want to 'do' they want to 'know'. They do not want to physically practice. They simply want to understand. Kinaesthetic learners are not likely to be able to sit alone and listen quietly and patiently to a lecture in the classroom. That is why this style of learning completely disappeared in the clinical students.

Table 4: Comparison of Multi modal preferences in Premedical and non-premedical students and between males and females

REFERENCE		QUAD-MODAL	TRI-MODAL					BI-MODAL					Total
		VAR K (%)	VAR (%)	VAK (%)	VRK (%)	ARK (%)	VA (%)	VR (%)	VK (%)	AR (%)	AK (%)	RK (%)	
Slater et al, 2007	Male	13 (56.7)	1 (4.3)	1 (4.3)	5 (21.7)	0	1 (4.3)	0	2 (8.7)	0	0	0	23
	Female	12 (40)	2 (6.7)	1 (3.3)	2 (6.7)	3 (10)	0	2 (6.7)	1 (3.3)	1 (3.3)	1 (3.3)	5 (16.7)	30
Breckler et al, 2009	Pre-medical	25 (45.4)	2 (3.6)	2 (3.6)	3 (5.5)	2 (3.6)	1 (1.8)	3 (5.5)	5 (9.1)	0	4 (7.3)	8 (14.6)	55
	Non pre-medical	43 (55.8)	2 (2.6)	4 (5.2)	3 (3.9)	4 (5.2)	0	4 (5.2)	4 (5.2)	3 (3.9)	3 (3.9)	7 (9.1)	77
Our study	Female Medical students	31 (32)	4 (4.1)	13 (13.4)	9 (9.3)	13 (13.4)	2 (2.1)	2 (2.1)	6 (6.2)	2 (2.1)	14 (14.3)	1 (1)	97



The difference in the preferred learning styles between clinical and preclinical students pose a possibility that the learning style can be changed by changing the learning resources. Meta-analysis of learning style applications in higher education, however, indicates that

preferences may shift if a student perceives this as necessary to master the learning objectives (Pinto *et al.*, 1994).

The clinical phase may force the appearance of certain preferences in the students. Dealing

with patients rather than books and notes may lead the students to develop other needed skills which can be reflected on their learning preferences. A longitudinal study tracking incoming medical students' learning preferences and continuing throughout their stay in the medical school may provide an answer for all these queries.

Conclusion

Using the VARK questionnaire helped in identifying the different learning styles of preclinical and clinical students in Dubai Medical College. These results should be taken in account by all staff in the college to assist both the learner and educator in identifying individual student preferences in the manner in which information is presented. A hypothesis that medical students had a higher preference for kinaesthetic perception and learning compared to average students was confirmed in this study. Further studies are recommended to investigate the correlation between different learning styles and performance of the students in different types of exams (e.g. Will Kinaesthetic learners perform better in practical exams?) and to follow up the shift in the learning styles of the students over the years of the college.

References

- Bedford, T.A. (2006) Learning Styles: a Review of Literature 1st draft Toowoomba, Australia: OPACS, The University of Southern Queensland.
- Breckler J. & Joun D & Ngo, H. (2009) Learning styles of physiology students interested in the health professions, *Advances in Physiology Education*, 33, pp. 30–36.
- Brown, T., Cosgriff, T. & French, G. (2008) Learning Style Preferences of Occupational Therapy, Physiotherapy and Speech Pathology Students: A Comparative Study, *The Internet Journal of Allied Health Sciences and Practice*, 6, 3, pp.1-12.
- Cavanagh, S.J. & Coffin, D.A. (1993) Matching instructional preference and teaching styles: A review of literature, *Nurse Education Today*, 14, pp. 106-110.
- Chan, V., Pisegna J.M., Rosian, R.R. & DiCarlo, S.E. (1991) Construction of a model demonstrating neural pathways and reflex arcs, *Advances in Physiology Education*, 271, pp. 14–42.
- Cortright, R.N., Collins, H.L. & DiCarlo, S.E. (2005) Peer instruction enhanced meaningful learning: ability to solve novel problems, *Advances in Physiology Education*, 29, pp. 107–111.
- DiCarlo, S.E., Sipe, E., Layshock, J.P. & Rosian, R.L. (1998) *Experiments and Demonstrations in Physiology*. Upper Saddle River, NJ: Prentice Hall.
- Erkus, H., Topcu U., Yuksel K, Mohamed, M., Kılıc, M., Rjab, M., Dedebali, Ö. & Şemin, I. (2006) Tıp Fakültesinde Öğrencilerinde Öğrenme Stilleri ile Eğitim Yöntemleri Arasındaki İlişkinin Arasştırılması. IV. Cukurova, Turkey: Ulusal Tıp Eğitimi Kongresi, Cukurova Üniversitesi.
- Fleming, N.D. & Mills, C. (1992) Not another inventory, rather a catalyst for reflection, *To Improve Academy*, 11, pp. 137–144.
- Fleming, N.D. (2008) VARK: a guide to learning styles. [Online] Available from: www.vark-learn.com/english [Accessed on January 7, 2009].
- Fleming, Neil. & Bonwell, Charles. (2007). VARK - Advice to Users of the Questionnaire, [Online] Available from: www.ntlf.com/html/lib/suppmat74vark2.htm [Accessed on January 2009].
- James, W. & Gardner, D. (1995) Learning styles: implications for distance learning, *New Direction for Adult Continuing Education*, 67, pp. 19–32.
- Kuipers, J.C. & Clemens, D.L. (1998) Do I dare? Using role-play as a teaching strategy. *Journal of Psychosocial Nursing and Mental Health Services*, 36, pp.12–17.
- Lujan, H.L. & DiCarlo, S.E. (2006) First-year medical students prefer multiple learning styles, *Advances in Physiology Education*, 30, pp. 13–16.
- Murphy, R. J., Gray, S. A., Straja, S. R. & Bogert, M. C. (2004) Student learning preferences and teaching implications: educational methodologies, *Journal of Dental Education*, 68, 8, pp. 859-866.
- Pinto, J.K., Geiger, M.A. & Boyle, E.J. (1994) A three-year longitudinal study of changes in student learning styles, *Journal of College Student Development*, 35, pp.113-9.
- Rao, S.P. & DiCarlo, S.E (2000) Peer instruction improves performance on quizzes, *Advances in Physiology Education*, 24, pp. 51–55.
- Rodenbaugh, D.W., Collins, H.L. & DiCarlo, S.E. (1999) Construction of a model demonstrating cardiovascular principles, *Advances in Physiology Education*, 277, pp. 67–83.

- Slater, J., Lujan, H.L. & DiCarlo, S. (2007). Does gender influence learning style preferences of first year medical students? *Advances in Physiology Education*, 31, pp. 336-342.
- Stensmo, C. (2006). Perceptual preferences in learning among teacher education students in practical-aesthetical subjects, Paper presented at NFPF- conference in Örebro.
- Tanner, K. & Allen, D. (2004) Approaches to biology teaching and learning: learning styles and the problem of instructional selection-engaging all students in science courses, *Cell Biology Education*, 3, pp.197–201.
- Wehrwein, E., Lujan, H. & DiCarlo, S. (2007). Gender difference in learning style preferences among undergraduate physiology student, *Advances in Physiology Education*, 31, pp.153-175.
- Zeynep, Baykan. & Melis, Nacar (2007) Learning styles of first-year medical students attending Erciyes University in Kayseri, Turkey, *Advances in Physiology Education*, 31, pp. 158–160.