Does gender influence learning style preferences of first-year medical students?

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Slater JA, Lujan HL, DiCarlo SE. Does gender influence learning style preferences of first-year medical students? Adv Physiol Educ 31: 336–342, 2007; doi:10.1152/advan.00010.2007.—Students have specific learning style preferences, and these preferences may be different between male and female students. Understanding a student’s learning style preference is an important consideration when designing classroom instruction. Therefore, we administered the visual, auditory, reading/writing, kinesthetic (VARK) learning preferences questionnaire to our first-year medical students; 38.8% (97 of 250 students) of the students returned the completed questionnaire. Both male (56.1%) and female (56.7%) students preferred multiple modes of information presentation, and the numbers and types of modality combinations were not significantly different between genders. Although not significantly different, the female student population tended to be more diverse than the male population, encompassing a broader range of sensory modality combinations within their preference profiles. Instructors need to be cognizant of these differences and broaden their range of presentation styles accordingly.

One of the many characteristics that make up a student’s learning style is the sensory modality by which the student prefers to take in new information. Three major sensory modalities have been defined: visual (V), aural (A), and kinesthetic (K), collectively known as VAK. VAK categorizes student learning based on the neural system that is preferred when receiving information. This classification system was recently expanded by Fleming to VARK to further differentiate the visual category into two categories: those who prefer graphical or pictorial representations of their incoming information (V) and those who prefer textual representations (reading/writing (R)).

We were interested in developing teaching approaches to address the learning needs of all of our medical students, male and female. To better understand our learners and their learning style characteristics, and to assist in the development of teaching strategies that will maximize motivation and learning for students of both genders, we administered Fleming’s VARK questionnaire for assessing sensory modality preference to our first-year medical students.

METHODS

Population and sample. Participants in this study consisted of first-year medical students at Wayne State University School of Medicine. A total of 97 students from a population of 250 completed the questionnaire (38.8%; 53 females, 41 males, and 3 unspecified). This study was reviewed and approved by the Human Investigation Committee of the Institutional Review Board of Wayne State University.

Instrumentation. The VARK questionnaire developed by Fleming (12) was used to identify one facet of student learning styles: the sensory modality by which they prefer to take in information. The VARK questionnaire is a 13-item, self-reported, multiple-choice questionnaire that can be completed in ~10–15 min (see the Appendix). The newest version of the VARK questionnaire consists of 16 questions and can be accessed at http://www.vark-learn.com/english/page.asp?p=questionnaire (12).

We administered the VARK questionnaire to our first-year medical students during the respiratory component of their physiology course. A hard copy was included with the class packet for the course, and students returned the completed questionnaire at the end of the respiratory section of the course.

Analysis. Students were allowed to choose multiple answers per item to adequately describe their preferred response(s) to the situations presented. The total number of student responses was tallied for each of the four sensory modalities (V, A, R, and K) and for all possible combinations of the modalities (e.g., VA, VRK, etc.). The scoring algorithm on the VARK website was then applied to identify each student’s modality preferences.

The number of students who preferred each mode of information presentation was divided by the total number of student responses to determine the percentage of students in each category. A χ² analysis was performed to determine if significant gender differences exist for each of the following situations: 1) multimodality and unimodality...
preferences between males and females (Fig. 1); 2) quad-, tri-, and bimodality preferences between males and females (Fig. 2); and 3) unimodal preferences between males and females (Fig. 3).

RESULTS

Figure 1A shows the percentages of male and female students who preferred multimodal and unimodal styles of information presentation. A similar percentage of males (56.1%) and females (56.6%) preferred information to reach them via multiple sensory modalities (multimodal). In addition, a similar percentage of male (43.9%) and female (43.4%) students preferred using a single sensory modality for information intake and are described as unimodal. Of the students who preferred unimodal presentation of information (either V, A, R, or K), some students preferred single V (2.4% male vs. 7.5% female), single A (4.9% male vs. 5.6% female), single R (9.8% male vs. 11.3% female), or single K (26.8% male vs. 18.9% female) modalities. There were no gender differences in the percentages of males and female students who preferred multimodal or unimodal styles of information presentation (Fig. 1B; P = 0.758).

Figure 2A shows the percentages of male and female students who preferred two, three, or four modes of information presentation. Some students preferred two modes (bimodal, 13.0% male vs. 33.3% female), some students preferred three modes (trimodal, 30.4% male vs. 26.7% female), and some students preferred four modes (quadmodal, 56.5% male vs. 40.0% female). There were no gender differences in the percentages of males and female students who preferred bi-, tri-, or quadmodal styles of information presentation (Fig. 2B; P = 0.223).

Figure 3A shows the breakdown of bi-, tri-, and quadmodal preferences by gender. Of the male and female students who showed a preference for two modes of information processing, some students preferred the combination of modes V and K (8.7% males vs. 3.3% females), some students preferred V and A (4.3% males vs. 0% females), some students preferred R and K (0% males vs. 16.7% females), some students preferred V and R (0% males vs. 6.7% females), some students preferred A and R (0% males vs. 3.3% females), and some students preferred A and K (0% males vs. 3.3% females). Of the male and female students who preferred three modes of information processing, some students preferred the combination of modes V, R, and K (21.7% males vs. 6.7% females), some students preferred V, A, and R (4.3% males vs. 6.7% females), some students preferred V, A, and K (4.3% males vs. 3.3% females), and some students preferred A, R, and K (0% males vs. 10.0% females). A number of male and female students were quadmodal, preferring all four modes of information processing (V, A, R, and K: 56.5% males vs. 40.0% females). There were no gender differences in the specific multimodal preferences between males and females (Fig. 3B; P = 0.159).

Although there were no gender differences in any of the specific preferences tested, it was interesting to note that of the six possible bimodal combinations (VA, VR, VK, AR, AK, and AK),
and RK), five were represented in the female student population (VR, VK, AR, AK, and RK), but only two were represented in the male population (VA and VK). Of the four possible trimodal combinations (VAR, VAK, VRK, and ARK), all four were represented in the female student population, but only three were represented in the male population (VAR, VAK, and VRK). Furthermore, 40% of female multimodal learners reported a preference for using all four sensory modalities (VARK). This is in contrast to the male population, in which well over half (56.5%) of multimodal male learners reported using all four sensory modalities as their preference (VARK).

Of all male learners, the percentage whose learning style preference contained V somewhere in their profile (whether it was their unimodal choice or contained within one of the male multimodal combinations, such as VA, VK, VAK, VAR, VRK, or VARK) was 58.5%. In contrast, 45.3% of females preferred V in their modality mix. Similar percentages of males and females preferred A in their modality mix (43.9% vs. 43.4%, respectively), either as a unimodal preference or part of a multimodal combination. R was preferred by 56.1% of males to 62.3% of females in their modality mix; and K was preferred by 78.0% of males to 66.0% of females in their modality mix. Although none of these differences reached statistical significance, these differences merit further investigation.

**DISCUSSION**

**Both males and females preferred multimodal learning.** In this study, we administered the VARK questionnaire of sensory modality preferences to first-year medical students to observe potential differences between the preferences of male and female students. Modality preference was similar between genders; both male (56.1%) and female (56.6%) students reported a preference for learning that utilizes multiple sensory modalities over unimodal learning. This is not surprising; it should be noted that in the general sense, all physically unimpaired students are multimodal, using all their senses to take in information at any given time. This preference for multimodal learning is in agreement with studies of first-year medical (3, 23) and dental students (28).

The multimodal preference of the majority of male and female medical students contrasts, however, with our previous study (38) of undergraduate physiology students. In this study (38), male undergraduate students had multimodal preferences, but female undergraduate students preferred unimodal styles. It is possible that multimodal learners have stronger learning outcomes that better qualify them for admission to medical or dental school (and/or that these schools inadvertently select for multimodal learners). However, further studies of the undergraduate student population are required to understand these results.
Male and female multimodal learners. Although both males and females preferred multimodal learning to a similar degree, nonsignificant variations between the genders were revealed upon further classification based on the possible combinations of sensory modalities. Specifically, female styles may be more diverse, with 10 of the 11 possible combinations represented in this population. Male styles, in contrast, were concentrated in a smaller subset, with only 6 of the 11 possible combinations represented. For example, female multimodal styles included three auditory combinations (AK, AR, and ARK), which were entirely missing from the male multimodal profile in this study. This supports the findings of Philibin (30), who, with the use of the Kolb Learning Style Inventory, found that males identified with a small subset of learning styles, whereas females distributed more broadly across the learning style spectrum.

The tendency toward greater diversity among the female population extends to other educationally pertinent areas besides learning style. Female adolescents reported a preference for variety in their educational resources. These observations are of special note due to the fact that the majority of medical school faculty members are male (2). Without conscious attention to varying presentation style, the social context of learning, and the resources available to students, a predominantly male faculty may inadvertently aim its instruction at a subset of students.

Male and female unimodal learners. Those students that are classified by the VARK algorithm as being unimodal learners express a stronger preference for taking in information by a single sensory modality. For example, a student whose VARK scores were V, A, R, and K would be categorized as having a unimodal preference for visual modes of information intake, although that student did not exclude use of the other modalities. The visual preference would lead these students to use learning strategies associated with that preference when the context allowed it.

The VARK questionnaire was selected for its ease of use (a simple 13-item survey), its free availability online, and the ease with which students and faculty can identify their preferences.

Fig. 3. A: percentages of male and female students who preferred specific multimodal combinations. Of the male and female students who preferred three modes of information presentation, some students preferred V, R, and K (21.7% male vs. 6.7% female), some students preferred V, A, and R (4.3% male vs. 6.7% female), some students preferred V, A, and K (4.3% male vs. 3.3% female), and some students preferred A, R, and K (0% males vs. 10.0% female). Of the students who preferred two modes of information presentation, some students preferred V and K (8.7% male vs. 3.3% female), some students preferred V and A (4.3% male vs. 0% female), some students preferred R and K (0% male vs. 16.7% female), some students preferred V and R (0% male vs. 6.7% female), some students preferred A and R (0% male vs. 3.3% female), and some students preferred A and K (0% male vs. 3.3% female). Of the male and female students who preferred four modes of information presentation, all students preferred V, A, R, and K (56.5% male vs. 40.0% female), respectively. B: contingency table used to determine the relationship between gender (male and female) and specific multimodal learning preferences (VARK, VAR, VAK, VRK, ARK, VA, VR, VK, AR, AK, and RK).

<table>
<thead>
<tr>
<th>Gender</th>
<th>VARK</th>
<th>VAR</th>
<th>VAK</th>
<th>VRK</th>
<th>ARK</th>
<th>VA</th>
<th>VR</th>
<th>VK</th>
<th>AR</th>
<th>AK</th>
<th>RK</th>
<th>Total number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>13</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>23</td>
</tr>
<tr>
<td>Female</td>
<td>12</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>30</td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>7</td>
<td>53</td>
</tr>
</tbody>
</table>
Instructors can utilize its results to learn more about student learning styles. There is substantial evidence for the existence of modality-specific strengths and weaknesses (e.g., visual, auditory, or kinesthetic processing) in people with various types of learning difficulty (35). Furthermore, whether tasks or activities are presented to appeal to auditory, visual, tactile, or kinesthetic senses (modality preference) is an important consideration for educators (4).

The creators of the VARK tool suggest that it is most appropriately used as a catalyst for reflection and discussion and that students should use the information to adjust study habits to correspond to their individual learning strengths. Data suggests that merely being knowledgeable about learning styles can improve student learning outcomes (13). To that end, instructors could administer the VARK questionnaire to students to raise students’ awareness level of their preferred learning modality, to give students and instructors a common language for discussing learning, and to help empower students to adjust their learning behaviors to take advantage of their strengths and preferences. This type of knowledge may increase students’ ability to actively cope with the rigorous academic demands of medical school. Use of active coping skills has been found to decrease anxiety and depression and to increase motivation among medical students (37).

Instructors can also use the self-reported VARK results from each individual class to become aware of the distribution of information intake preferences among each class and to adjust their method of information delivery to correspond with these preferences. These adjustments would benefit both male and female learners. For example, V-type learners can be targeted by the presence of models and demonstrations (5). A-type learners can be reached through discussion during peer instruction (8, 32), collaborative testing (9, 31), debate (36), games (1, 7, 18, 25, 27, 29), and answering questions (10). Manipulating models (5) and role playing (22) can satisfy K-type learners. Furthermore, investigators have reported an increase in students’ achievement with the use of simulations and games, and students usually expressed positive feelings about the experiences (39). Awareness of an individual class’ learning preferences allows for effective teaching that will reach students learning via different modalities.

When instruction in undergraduate courses matched students’ learning style preferences, students achieved higher scores than when mismatched (24). Rochford (33) found that using learning style responsive materials to instruct remedial writing students at an urban community college resulted in significantly higher achievement. Miller (26) found that both student examination scores and student’s attitude toward learning scores were significantly higher when presentation was matched with student learning styles. Insight into the specific preferences of individual classes would help instructors tailor both their presentations and methods of assessment for each individual class. In addition, the present study suggests that females may have a broader range of learning preferences than males. Instructors need to be cognizant of these differences and broaden their range of presentation accordingly.

An opposing viewpoint that exists in the literature asks whether it is most advantageous to teach primarily using a mode that matches an individual’s preferred learning style or whether a deliberate mismatch may actually produce stronger results for the learner. Grasha (14) argued that an environment in which delivery of the material is matched to the learner’s preferred style would eventually bore the student, causing the learner to disengage. A deliberate mismatch could prevent boredom and stretch an individual to grow and learn. This was supported by research that showed that even individuals with strong learning style preferences preferred a variety of teaching approaches to avoid boredom (15). Kelly and Tangney (12) showed that students with “low levels of learning activity” actually learned more when presented first with their least preferred material and resources. It is important to note that the efficacy of mismatching as a primary strategy for improving student learning outcomes has not been shown (21). Mismatching is suggested as an occasional teaching strategy employed to stimulate interest, and not as an alternative or replacement for matching. In any case, whether the reasoning for using multiple styles of delivery is to match students’ learning style preferences, or to offer a combination of preferred/mismatched styles to hold attention and stretch the student, an instructor who varies teaching approaches is more likely to meet student needs.

**Limitations.** The VARK self-reported questionnaire has not been statistically validated, and this represents a limitation to this study. Educational investigators have not been able to find a satisfactory statistical method to validate the four-factor model that is the basis of VARK (12). Dr. Marilla Svinicki of the University of Texas at Austin suggests that the problem is due, in part, to the wording of some of the items, which confuse the perspective of the learner with the individual with whom the learner might be communicating, and the multiple options that an individual can choose in answering (12). These concerns have been addressed recently by the VARK creator, and a new 16-item questionnaire that consistently uses the first person was posted on the website in October 2006 (12). Nonetheless, since these data were obtained with an older version of the tool, they may not be generalizable without corroborating evidence, such as longitudinal evaluation of student preferences lasting throughout the students’ medical school tenure (6).

Another limitation of this study, and any using the VARK questionnaire as designed, is that it does not account for confounding factors such as socioeconomic status, race, culture, etc. The relatively homogenous population surveyed in this study will tend to have less variety in these factors; however, it remains a drawback of this survey.

A strong point of the VARK questionnaire is that its questions and options are drawn from real-life situations and respondents identify with the results that they receive—they affirm the face validity of the tool. For example, 60% of respondents on the VARK website reported that their VARK results match what they perceive to be their learning preferences. Fewer than 5% reported that their results do not describe their preferred modalities. The remaining respondents say they do not know whether their results match their preferences. It is important to note, however, that although the number of samples is very large, self-reported data may be biased because all data are self-selected; there is no randomization or balanced selection. Furthermore, there are no controls for repeated sample entry, so an unknown number of data sets are in fact replicates. However, although self-perceptions are not always reliable, these data support the validity of the VARK questionnaire.
Conclusions. This study revealed gender differences in preferred methods of information delivery and suggests that the female student population is more diverse than the male population, encompassing a broader range of sensory modality preferences. Instructors need to be cognizant of these differences and broaden their range of presentation styles accordingly to be an effective educator.

APPENDIX: THE VARK QUESTIONNAIRE

1. You are about to give directions to a person who is standing with you. She is staying in a hotel and wants to visit your house later. She has a rental car. You would:
   A. draw a map on paper.
   B. tell her the directions.
   C. write down the directions (without a map).
   D. collect her from the hotel in my car.

2. You are not sure whether a word should be spelled “dependent” or “dependant.” You would:
   A. look it up in the dictionary.
   B. see the word in my mind and choose by the way it looks.
   C. sound it out in my mind.
   D. write both versions down on paper and choose one.

3. You have just received a copy of your itinerary for a world trip. This is of interest to a friend. You would:
   A. phone her immediately and tell her about it.
   B. send her a copy of the printed itinerary.
   C. show her on a map of the world.
   D. share what I plan to do at each place I visit.

4. You are about to cook something as a special treat for your family. You would:
   A. cook something familiar without the need for instructions.
   B. thumb through the cookbook looking for ideas from the pictures.
   C. refer to a specific cookbook where there is a good recipe.
   D. visual clues–pictures, diagrams, charts.

5. A group of tourists has been assigned to you to find out about wildlife reserves or parks. You would:
   A. drive them to a wildlife reserve or park.
   B. show them slides and photographs.
   C. give them pamphlets or a book on wildlife reserves or parks.
   D. tell me what is wrong.

6. You are about to purchase a new stereo. Other than price, what would most influence your decision?
   A. written instructions.
   B. flow diagrams, charts, graphs.
   C. field trips, labs, practical sessions.
   D. discussion, guest speakers.

7. You are about to learn to use a new program on a computer. You would:
   A. sit down at the keyboard and begin to experiment with the program’s features.
   B. use a model to show me what is wrong.
   C. show me a diagram of what is wrong.
   D. tell me the directions.

8. You have an eye problem. You would prefer the doctor to:
   A. tell me what is wrong.
   B. show me a diagram of what is wrong.
   C. use a model to show me what is wrong.

9. You are about to learn to use a new program on a computer. You would:
   A. draw me a map on paper.
   B. tell me the directions.
   C. write down the directions (without a map).
   D. collect me from the hotel in their car.

11. Apart from the price, what would most influence your decision to buy a particular textbook?
   A. I have used a copy before.
   B. a friend talking about it.
   C. quickly reading parts of it.
   D. the way it looks is appealing.

12. A new movie has arrived in town. What would most influence your decision to go (or not go)?
   A. I heard a radio review about it.
   B. I read a review about it.
   C. I saw a preview of it.
   D. I read a review about it.

13. Do you prefer a lecturer or teacher who likes to use:
   A. a textbook, handouts, readings.
   B. flow diagrams, charts, graphs.
   C. field trips, labs, practical sessions.
   D. discussion, guest speakers.

REFERENCES