Residency program directors use national licensing examination scores as a proxy of aptitude for postgraduate specialty training. Therefore, high examination scores are essential for medical students, who rely on high scores for residency program admissions.

However, examination scores are more complicated than they appear. Several studies have correlated students’ psychological or personality type with academic performance. For example, Scholastic Aptitude Test scores, which are used for college admissions, in both the math and verbal sections are higher for students with a preference for perceiving their environments through “intuition” rather than “sensing,” as defined by the Myers-Briggs Type Indicator (MBTI). By contrast, the highest grades in an undergraduate physiology course were achieved by students with a sensing preference. When making judgments, medical students with a “thinking” preference—as opposed to a “feeling” preference—had a record of higher academic achievement. When considering these data and other published research, there may be demonstrated educational benefits of aligning personality types and learning preferences to improve motivation and examination scores among students.

Learning Style

Carl Jung posed that two basic attitudes (extraversion and introversion) and four functions (sensation, intuition, thinking, and feeling) comprise the unconscious psyche (ie, personality). Briggs and Briggs Myers expanded on this basic typology and developed the MBTI with the guiding assumption that individuals exhibit specific preferences while perceiving information and making judgments about situations, people, and ideas.

The MBTI is a psychological instrument used to determine personality type through a series of forced-choice questions. For example, “Do you prefer (A) giving a lecture, or (B) sitting in the audience?” The questions identify preferences along four dichotomies, as follows:

- **Extraversion-Introversion (EI)** represents the process through which a person is energized.
  - Is the individual’s primary interest in the outer world of people and things or the inner world of ideas and concepts?
- **Sensation-Intuition (SN)** describes an individual’s perception or awareness of his or her environment.

**Context:** Several studies have shown that the personality types of medical and dental students affect performance on aptitude and achievement examinations. However, such studies are lacking in osteopathic medical literature.

**Objective:** To determine if personality type is associated with performance on aptitude and achievement tests taken by osteopathic medical students.

**Methods:** The Myers-Briggs Type Indicator (MBTI) was used to determine the mental-function pairs—sensing-thinking, intuition-thinking, sensing-feeling, or intuition-feeling—of osteopathic medical students at Midwestern University/Chicago College of Osteopathic Medicine in Downers Grove, Ill. Results were analyzed with participants’ scores on the Medical College Admissions Test and the Comprehensive Osteopathic Medical Licensing Examination-USA (COMLEX-USA) Level 1.

**Results:** A total of 295 osteopathic medical students completed the MBTI, but 32 (11%) were excluded because they did not meet the study criteria. Among the remaining 263 participants, no personality types were associated with high or low scores on the Medical College Admissions Test ($P = .229$). However, participants in the intuition-feeling group had statistically significant lower scores on COMLEX-USA Level 1 ($P = .002$).

**Conclusion:** The differences in scores obtained on COMLEX-USA Level 1 were statistically significant when students were identified by personality type. This finding suggests that using the MBTI during training could enhance learning and improve academic performance in osteopathic medical schools.
Is the person more “in tune” with facts and details or possibilities and hunches?

- Thinking-Feeling (TF) relates to a person’s preference for making judgments. Is the individual objective and logical or subjective and personal?
- Judgment-Perception (JP) describes a person’s orientation to or interaction with the environment. Is the person more organized and orderly or flexible and spontaneous?

Combining one component from each of the four dichotomies, the MBTI identifies 16 personality types (eg, ESTJ, ISFP). Based on their personality types, individuals respond differently to similar situations and have varying interests, values, needs, motivations, and learning styles.

The SN and TF dichotomies are further used to identify four mental-function pairs based on how information is gathered and how judgments are made. Each of these four mental-function pairs—sensing-thinking (ST), intuition-thinking (NT), sensing-feeling (SF), and intuition-feeling (NF)—may influence scores on medical school examinations. For example, in one study,9 first-year medical students with the ST combination had the highest scores in a neurochemistry course. Another study10 found that the highest rate of failure (42%) among first-time National Board of Medical Examiners (NBME) Part 1 examinees occurred among those in the NF group.

However, individuals’ academic achievements are not necessarily restricted by their mental-function pairs. In fact, medical students who can process information and analyze problems using more than just their preferred mental-function pair have been reported to perform better on examinations.11

To better understand the MBTI mental-function pairs, a review of the decision-making styles outlined by Rowe and Mason12 is helpful.

Decision-Making Style

During multiple-choice question examinations, students select answers based on their interpretation of the information presented, current knowledge, and decision-making style. Rowe and Mason12 expanded on the MBTI by describing four decision-making styles—the cognitive processes through which individuals perceive and respond to information—based on two dimensions: value orientation and level of cognitive complexity.

Value orientation represents the degree to which a concern for people or task influences a decision. A high degree of concern for people when making decisions is comparable to the feeling (F) mental function, while a lesser degree is comparable to the thinking (T) function.12

Level of cognitive complexity reflects the degree to which a need for information and structure impacts a decision. A person using a low level of cognitive complexity tends to use less information when making decisions, whereas an individual who prefers a high level of cognitive complexity requires much more information and will carefully process it before making a decision. Individuals who employ a high level of cognitive complexity when making decisions are comparable to those who prefer to use their sensing (S) mental function, while those who use a low degree are comparable to the intuitive (N) function.12

Combining the dimensions results in four decision-making styles,12 as follows:

- Analytic—Individuals are focused on information and tasks. They prefer as many facts as possible and consider many alternatives before making a decision. Careful analysis of a situation and maximal achievement are important to them. The analytic style approximates the MBTI mental-function pair of ST.
- Directive—Individuals are less focused on information but remain focused on tasks. They tend to solve problems quickly because efficiency tends to be important to this type of decision-maker. The directive style is comparable to the MBTI mental-function pair of NT.
- Behavioral—Individuals focus less on details and more on personal connections with people and their feelings. They consider the big picture and impact on others when making decisions. The behavioral style corresponds to the MBTI mental-function pair of NF.
- Conceptual—Like those in the behavioral style, conceptual individuals make a personal connection but need more information when making decisions. They tend to make subjective decisions based on a lot of information from many sources. The conceptual style is comparable to the MBTI mental-function pair of SF.

The basic qualities of each of these decision-making styles are presented in the Figure.

Implications of Personality Type

Academic performance on examinations is the result of interactions among multiple variables that include learning and decision-making style. These elements of personality type can influence outcomes on aptitude tests, which measure a student’s ability to learn (ie, future performance), as well as achievement tests, which identify what a student has learned.

For example, the Medical College Admission Test (MCAT) is an aptitude examination taken by prospective medical students. Scores are evaluated by medical schools during the admissions process based on the rationale that MCAT scores may predict academic success.13 One study14 found that MCAT verbal reasoning scores (r=0.16), physical science scores (r=0.43), and biological science scores (r=0.44) are correlated to a high level of academic performance on Level 1 of the Comprehen-
sive Osteopathic Medical Licensing Examination-USA (COMLEX-USA), an achievement test with a series of three levels.

The National Board of Osteopathic Medical Examiners (NBOME) administers COMLEX-USA. Level 1 of this examination emphasizes the scientific understanding of the mechanisms of medical problems and disease processes. The mean score for COMLEX-USA is 500.15 To pass the test, students must obtain a score of at least 400.15 Grade point averages during osteopathic medical school (year 1, r=0.78; year 2, r=0.83) have been reported to correlate to COMLEX-USA scores, which were forwarded by the NBOME.

As noted earlier, those with an “intuitive” preference score higher than those with a “sensing” preference on the two-part Scholastic Aptitude Test,3 and undergraduate medical students with a thinking preference have higher scores that those with a feeling preference.5 Therefore, we hypothesized that students with the NT mental-function pair would have higher MCAT scores than SF students. Also, based on previously published findings,9,10 it was expected that students with the ST mental-function pair would outperform those with NF preferences on COMLEX-USA Level 1.

Methods

Students from Midwestern University/Chicago College of Osteopathic Medicine (MWU/CCOM) in Downers Grove, Ill, participated in the present study. The study protocol was reviewed and approved by Midwestern University’s institutional review board.

After a description of the rationale for the study was presented, students who gave consent to participate in the present study completed the MBTI instrument. Based on the objectives of the present study, Form M was used. This form, which was introduced in 1998, contains 93 questions and generally takes 20 to 30 minutes to complete.16 It is therefore shorter than other forms, which can have as many as 144 questions.16

In the 2006 winter quarter, the MBTI was administered during a single required course in which all second-year osteopathic medical students (class of 2009) were enrolled. The MBTI was also administered during the spring 2007 quarter to third-year students (class of 2008) in a required course. The form was distributed during two afternoon workshop sessions. The forms were collected and the results were analyzed by a qualified MBTI administrator (D.J.S.). All students who completed the form were debriefed on their MBTI results within 4 weeks of completing the instrument.

Participants’ MCAT scores were available from their admissions portfolios and were thus obtained from the MWU/CCOM Office of Admissions. Scores on COMLEX-USA Level 1 were from students’ first examination attempt, which occurred during the summer quarter immediately after completion of their second year of osteopathic medical school. The Office of the Dean provided the COMLEX-USA Level 1 scores, which were forwarded by the NBOME.

Students were excluded if they had completed their first 2 years of osteopathic medical school in an interrupted fashion or did not have a first-time score available for COMLEX-USA Level 1 taken within 45 days of the end of their second year of

Figure. Decision-making styles based on value orientation and level of cognitive complexity. The corresponding Myers-Briggs Type Indicator mental-function pairs are noted in parentheses. Abbreviations: NF, intuition-feeling; NT, intuition-thinking; SF, sensing-feeling; ST, sensing-thinking.
osteopathic medical school. Students who had taken the MBTI previously were required to retake it for participation in the present study.

Participants were divided according to MBTI mental-function pairs. Group assignments and scores from the MCAT and COMLEX-USA Level 1 were analyzed using SPSS statistical software (version 14.0; SPSS Inc, Chicago, Ill). To determine if a relationship existed between the MBTI and MCAT or COMLEX-USA Level 1 scores, one-way analysis of variance (ANOVA) was performed.

Results
In the first group (ie, second-year osteopathic medical students), all 163 participants (88 women, 75 men) completed the MBTI survey. The second group (ie, third-year osteopathic medical students) comprised 165 students (90 women, 75 men), of whom 132 participants (80%; 75 women, 57 men) completed and returned the MBTI form. Thirty-two students met exclusion criteria and were removed from final analysis. Therefore, the final study group comprised 263 participants (89.2%; 75 women, 124 men) of the 295 students from whom MBTI information was obtained.

Participants had a mean score of 26.0 on the MCAT and 512.4 on COMLEX-USA Level 1. Both of these mean scores were above the national reported mean score for osteopathic medical students. The range of MCAT scores among the four mental-function pairs was 25.4 in the SF group to 26.2 in the NF group. The range of COMLEX-USA Level 1 scores was 493.5 in the NF group to 535.2 in the ST group (Table 1).

Differences in MCAT scores were not statistically significant (P=0.229) among the four mental-function pairs. However, as shown in Table 2, COMLEX-USA Level 1 scores had statistically significant differences (P=0.002) based on MBTI type among the members of the study group.

Although further analysis of COMLEX-USA data revealed no statistically significant performance differences among the ST, NT, and SF groups, the lower scores in the NF group were significantly significant (P<0.05) when compared with each of the other three groups. The COMLEX-USA Level 1 scores for the mental-function pairs were also analyzed by sex, but the difference in mean scores was not statistically significant.

Comment
The objectives of the present study were to determine if a relationship exists between (1) MBTI mental-function pair and MCAT scores and (2) MBTI pair and COMLEX-USA Level 1 scores. Also, if a relationship was identified, we sought evidence regarding the influence of participants’ mental-function pairs. Although a statistically significant difference was not found with MCAT scores, such a relationship was identified using data from students’ COMLEX-USA Level 1 scores.

The aptitude of the participants was assumed equivalent based on MCAT scores, which did not differ substantially among the four mental-function pairs. The difference noted in COMLEX-USA Level 1 performance for the NF group when compared to that of the other pairs suggests that NF students possess a unique characteristic that results in lower scores. One potential explanation is that students with an NF mental-function pair have a preference for the big picture and process data less objectively and therefore tend to select incorrect answers on examinations that are detail-based and analytical by design (eg, COMLEX-USA Level 1). The MCAT, however, focuses mainly on less detailed, non-analytic–type questions, therefore explaining such students’ ability to excel in MCAT scores.

Thinking is essentially the processing of information. It involves taking information and manipulating it to make it understandable and useful to an individual. Students may primarily use their dominant mental-function pair when processing information.

The classic multi-store model of memory, which was first described by Atkinson and Shiffrin, describes three distinct parts of memory: sensory, short-term, and long-term.

Information—or stimuli—from the environment is first perceived by our senses and enters the sensory store. After processing, some of it enters the short-term store, also known as working memory. While in the working memory, information can be used to make a quick decision, moved to long-term memory, or forgotten. Unsworth and Engle examined individual differences in working memory and found that individuals with low working memory capacities demonstrated reduced performance on a number of attention and memory tasks when compared to indi-

Table 1
Mean MCAT and COMLEX-USA Level 1 Scores for Osteopathic Medical Students by MBTI Mental-Function Pair

<table>
<thead>
<tr>
<th>MBTI Mental-Function Pair</th>
<th>n</th>
<th>MCAT</th>
<th>COMLEX-USA Level 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensing-thinking</td>
<td>52</td>
<td>26.1 (2.7)</td>
<td>535.2 (76.8)</td>
</tr>
<tr>
<td>Intuition-thinking</td>
<td>42</td>
<td>26.1 (2.8)</td>
<td>529.0 (90.5)</td>
</tr>
<tr>
<td>Sensing-feeling</td>
<td>59</td>
<td>25.4 (2.2)</td>
<td>515.9 (71.9)</td>
</tr>
<tr>
<td>Intuition-feeling</td>
<td>110</td>
<td>26.2 (2.7)</td>
<td>493.5 (61.7)</td>
</tr>
<tr>
<td>Total</td>
<td>263</td>
<td>26.0 (2.6)</td>
<td>512.4 (73.8)</td>
</tr>
</tbody>
</table>

Abbreviations: COMLEX-USA, Comprehensive Osteopathic Medical Licensing Examination-USA; MBTI, Myers-Briggs Type Indicator; MCAT, Medical College Admissions Test.
viduals with higher working memory capacities.

Unsworth and Engle suggested that an executive control process develops over time that regulates cognitive function. This process guides individuals in the selection of approaches and strategies involved in problem solving. Perception and attention to specific information is directed through the executive control process, which may be reflected in the mental-function pairs. Future research is needed to examine the differences in performance among individuals with the NF mental-function pair and those with other function pairs to further study this possibility.

Although no single personality type determined by the MBTI is necessarily “better” than another in an absolute sense and each personality type has its own strengths and shortcomings, studies have reported that individuals with certain learning styles tend to perform better on standardized examinations than others. Therefore, it may be of merit to teach students to use more successful study and test-taking techniques for their individual personality types. Deliberate practice with appropriate, formative feedback, not merely the repetition of an activity, is required to substantially improve performance.

**Conclusion**

The results of the present study should encourage faculty at osteopathic medical schools to further evaluate the use of the MBTI and its value in student learning and testing. Additional studies with osteopathic medical students could address the following questions:

- Does coaching students to use more than their preferred mental-function pairs result in improved study skills and higher COMLEX-USA Level 1 scores?
- Do NF students find certain items on examinations distracting? In other words, do NF students tend to select test answers based on how they “feel” without critically reading the responses and relating them to the specific question asked? If so, can they be taught to avoid such distracters?
- Is the timed-response nature of COMLEX-USA Level 1 a special challenge for students with an NF mental-function pair?
- Are students in the NF group affected by some other factor (e.g., test-wise skills) that impedes their performance on COMLEX-USA Level 1?
- Are NF students challenged more by the quantity or density of material presented in osteopathic medical school or the pace of learning?

The present study has addressed the first step of improving student performance on examinations. However, many questions must be answered before the second step—developing a course of action—can be achieved.

**References**


**Table 2**

Analysis of Variance: Statistical Comparison of MBTI Mental-Function Pairs vs MCAT and COMLEX-USA Level 1 Scores for Osteopathic Medical Students

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F Score</th>
<th>F Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MCAT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>3</td>
<td>29.6</td>
<td>9.9</td>
<td>1.449</td>
<td>0.2290</td>
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<tr>
<td>Within Groups</td>
<td>259</td>
<td>1,762.6</td>
<td>6.8</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Total</td>
<td>262</td>
<td>1,792.1</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td><strong>COMLEX-USA Level 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>3</td>
<td>78,383.5</td>
<td>26,127.8</td>
<td>5.013</td>
<td>0.0021</td>
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<tr>
<td>Within Groups</td>
<td>259</td>
<td>1,349,861.1</td>
<td>5211.8</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Total</td>
<td>262</td>
<td>1,428,244.6</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

**Abbreviations:** COMLEX-USA, Comprehensive Osteopathic Medical Licensing Examination-USA; MBTI, Myers-Briggs Type Indicator; MCAT, Medical College Admission Test.


