

Pediatric Residents' Learning Styles and Temperaments and Their Relationships to Standardized Test Scores

SANJEEV Y. TULI, MD
LINDSAY A. THOMPSON, MD, MS
HEIDI SALIBA, BA
ERIK W. BLACK, PhD
KATHLEEN A. RYAN, MD
MARIA N. KELLY, MD
MAUREEN NOVAK, MD
JANE MELLOTT, MD
SONAL S. TULI, MD

Abstract

Background Board certification is an important professional qualification and a prerequisite for credentialing, and the Accreditation Council for Graduate Medical Education (ACGME) assesses board certification rates as a component of residency program effectiveness. To date, research has shown that preresidency measures, including National Board of Medical Examiners scores, Alpha Omega Alpha Honor Medical Society membership, or medical school grades poorly predict postresidency board examination scores. However, learning styles and temperament have been identified as factors that may affect test-taking performance. The purpose of this study is to characterize the learning styles and temperaments of pediatric residents and to evaluate their relationships to yearly in-service and postresidency board examination scores.

Methods This cross-sectional study analyzed the learning styles and temperaments of current and past pediatric residents by administration of 3 validated tools: the Kolb Learning Style Inventory, the Keirsey

Temperament Sorter, and the Felder-Silverman Learning Style test. These results were compared with known, normative, general and medical population data and evaluated for correlation to in-service examination and postresidency board examination scores.

Results The predominant learning style for pediatric residents was *converging* 44% (33 of 75 residents) and the predominant temperament was *guardian* 61% (34 of 56 residents). The learning style and temperament distribution of the residents was significantly different from published population data ($P = .002$ and $.04$, respectively). Learning styles, with one exception, were found to be unrelated to standardized test scores.

Conclusions The predominant learning style and temperament of pediatric residents is significantly different than that of the populations of general and medical trainees. However, learning styles and temperament do not predict outcomes on standardized in-service and board examinations in pediatric residents.

Introduction

Board certification is increasingly important as a quality measure—the quality of individual physicians—and is aggregated to the program level as a measure of the effectiveness of the residency education program.^{1,2} The general public values physicians with board certification or maintenance of certifications highly.³ However, the American Board of Pediatrics certification pass rates for first-time takers averages between 75% and 79%.⁴ There is no correlation between preresidency measures, such as National Board of Medical Examination scores, Alpha Omega Alpha membership, and medical school grades, and in-service or board-certification test performance.^{5–8}

The theory of experiential learning suggests that hereditary factors, life experiences, and the environment influence individuals' learning styles.⁹ Temperament is the

All authors are at the University of Florida. **Sanjeev Y. Tuli, MD**, is Associate Professor and Chief of the Division of Ambulatory Pediatrics; **Lindsay A. Thompson, MD, MS**, is Assistant Professor in the Division of Ambulatory Pediatrics and in Epidemiology and Health Policy Research; **Heidi Saliba, BA**, is Research Assistant in the Division of Ambulatory Pediatrics; **Erik W. Black, PhD**, is Assistant Professor in the Division of Ambulatory Pediatrics and in the College of Education, School of Teaching and Learning; **Kathleen A. Ryan, MD**, is Assistant Professor in the Division of Ambulatory Pediatrics; **Maria N. Kelly, MD**, is Assistant Professor in the Division of Ambulatory Pediatrics; **Maureen Novak, MD**, is Associate Professor in the Division of Ambulatory Pediatrics; **Jane Mellott, MD**, is Assistant Professor in the Division of Ambulatory Pediatrics; and **Sonal S. Tuli, MD**, is Associate Professor and Residency Program Director in the Department of Ophthalmology.

Funding: The authors report no external funding source.

Corresponding author: Sonal S. Tuli, MD, Department of Ophthalmology, University of Florida, 1600 SW Archer Road, Gainesville, FL 32610-0284, 352.273-7541

Received July 21, 2011; revision received May 24, 2011; accepted September 29, 2011.

DOI: <http://dx.doi.org/10.4300/JGME-D-10-00147.1>

configuration of individuals' traits, attitudes, values, and talents, which influences how they perceive information and subsequently apply it to life experiences.¹⁰ Temperament and learning styles could potentially influence academic achievement. Although there are studies that have investigated the influences of these psychosocial factors on academic achievement in undergraduate and graduate medical learners, the same investigation has not been done in pediatric residents.^{11–14} We sought to explore the relationship between pediatric residents' temperaments and learning styles and objective measures of pediatric residents' educational performance, specifically, standardized test performance.

Methods

We invited current residents of the University of Florida pediatric residency program and residents who had graduated from the program within the previous 6 years to participate in this investigation. The University of Florida Institutional Review Board reviewed and approved this study, and we obtained signed, informed consent from participants.

Temperament and Learning Style Identification

All participants were asked to complete 3 psychometric instruments: the Kolb Learning Style Inventory (KLSI), the Felder-Silverman Learning Style test (FSLs), and the Keirsey Temperament Sorter (KTS). The KLSI was paper-based, whereas the other 2 were online. The FSLs was free, whereas the other 2 tests had a per-test cost. We compared results to the normative data available for the KLSI and the KTS.

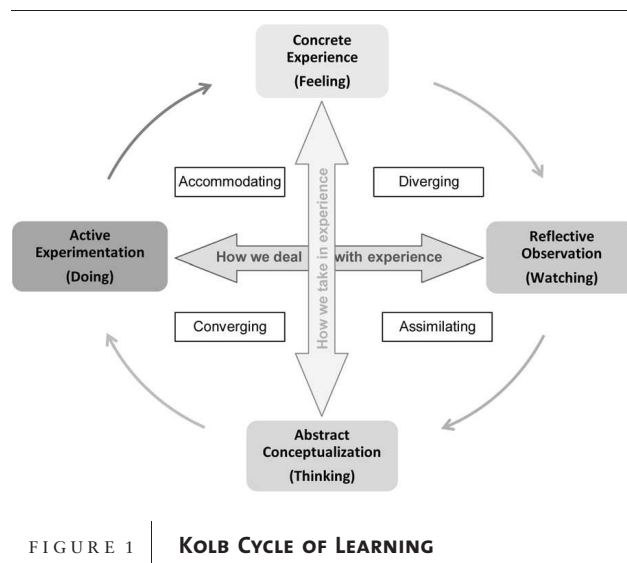
The KLSI determines an individual's predominant learning style based on the "Experiential Cycle of Learning" (FIGURE 1).¹⁵ It categorizes subjects into 4 styles (accommodators, assimilators, convergers, and divergers).

The FSLs is an online instrument used to assess preferences on 4 dimensions (active/reflective, sensing/intuitive, visual/verbal, and sequential/global).¹⁶ This test was used as an alternative to the KLSI for residents who had already graduated (because it could be completed online).¹⁶

The KTS is an online test that determines an individual's psychological personality^{10,17}: (artisan, guardian, idealist, and rational) and 16 subtypes, based on their relative preference for each of 4 pairs of scales (extraversion/introversion, sensation/intuition, thinking/feeling, and perception/judgment).

Standardized Test Data

In-service scores of all participating residents were obtained from the program director's resident files (no self-reports).



Board certification scores of former residents were obtained directly from the data center at the American Board of Pediatrics. We used the scores of these standardized tests as outcome variables for each participant's learning style and temperament.

Data Analysis

We used the χ^2 test to determine whether there was a dominant learning style or temperament among pediatric residents and to compare residents' KLSI and KTS distributions with population norms. Individual residents' temperament and learning style data were compared with their respective standardized test scores using descriptive statistics and analysis of variance procedures. We performed the analyses using Statistical Package for the Social Sciences (v. 17, formerly SPSS, Chicago, IL; now, IBM Corporation, Armonk, NY) with $P < .05$ being significant. Following data collection, we conducted a post hoc calculation of statistical power using G*Power.¹⁸

Results

Eighty-six of 150 current or former residents (57%) participated and completed at least 1 of 3 psychometric instruments. Most of the participants were current residents. The KLSI was completed by 75 residents (87.2% of participants), the FSLs by 46 residents (53.5%) and the KTS by 56 residents (65.1%). Thirty-seven residents (40.7%) completed all 3 tests. In-service examination (ISE) scores were available for all residents that participated in the study (100%), whereas board certification examination (BCE) scores from the American Board of Pediatrics were available for 60 residents (100% of participating residents who have graduated and taken the boards to date).

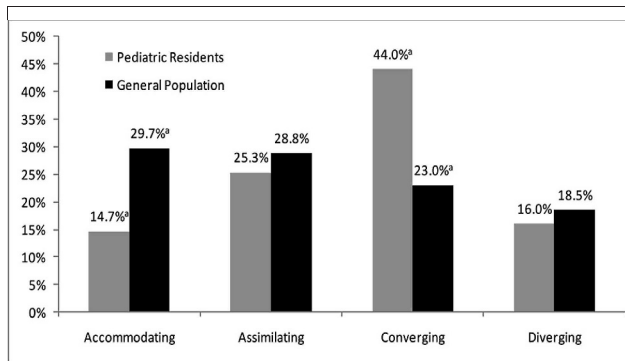
^a $p < .05$

FIGURE 2 | **KOLB LEARNING STYLE INDEX IN PEDIATRIC RESIDENTS COMPARED WITH THE GENERAL POPULATION**

Learning Styles KLSI (FIGURE 2)

The learning styles of the 75 pediatric residents that completed this assessment differed significantly from the general population overall ($P < .01$).^a Sex was evaluated as a possible confounding factor but was not significant.

Learning Styles FSLS (FIGURE 3)

After evaluation of the 46 residents that completed this assessment, certain patterns emerged. No generalized population data, or data from medical students or residents, was available for comparison. We compared the distribution of residents between the FSLS and the KLSI because both had scales that measured reflective versus active and sensing versus intuitive learning preferences and found that the distribution was different between the 2 tests ($n = 37$).

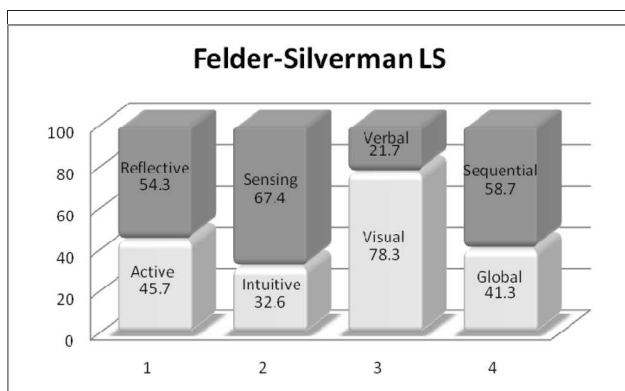


FIGURE 3 | **RELATIVE PREFERENCE OF PEDIATRIC RESIDENTS FOR THE 4 SCALES ON FELDER-SILVERMAN INDEX OF LEARNING STYLES**

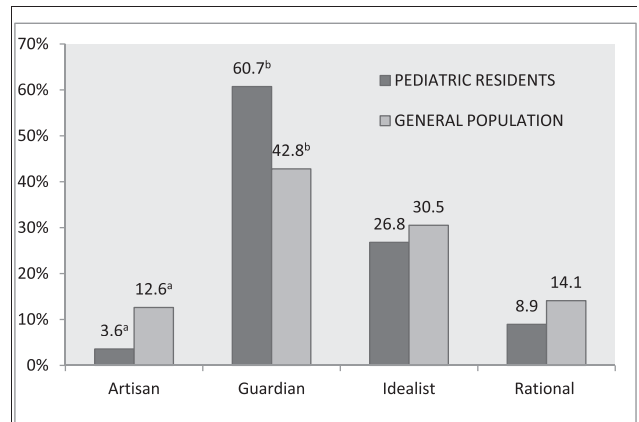
^a $P < .01$; ^b $P < .05$

FIGURE 4 | **PEDIATRIC RESIDENT TEMPERAMENT BY KEIRSEY TEMPERAMENT SORTER COMPARED WITH THE GENERAL POPULATION**

Temperament Styles KTS (FIGURE 4)

The temperament distribution of the 56 pediatric residents that completed this assessment was significantly different from the general population ($P = .04$)¹⁹ and did not vary significantly by sex.

ISE and BCE Performance (FIGURES 5 and 6)

As expected, the average score for the ISE for each residency year of training (postgraduate level [PL]-1, PL-2, and PL-3) increased with the years of residency training. Analysis of KLSI data (FIGURE 5) provides indication that there was little variation in in-training examination performance between learning styles, until the PL-3 year; after which, the *converging* style tended to score higher, on average. Also, residents with stronger inclinations toward

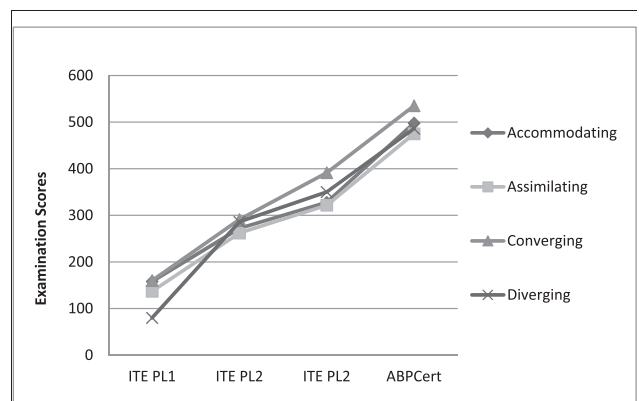
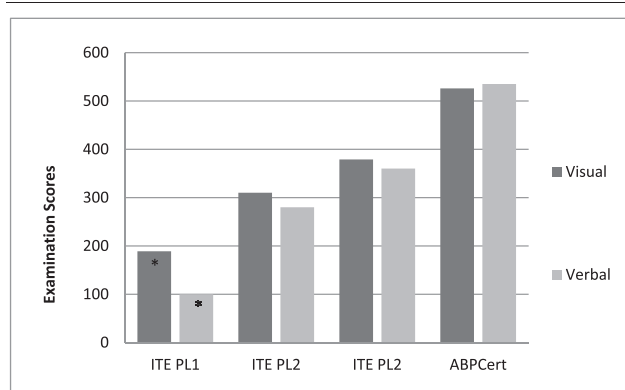


FIGURE 5 | **COMPARISON OF KOLB LEARNING STYLES WITH IN-SERVICE TRAINING EXAMINATION AND BOARD CERTIFICATIONS SCORES**



* $P = .004$

FIGURE 6 | COMPARISON OF IN-SERVICE TRAINING SCORES OF VISUAL VERSUS VERBAL LEARNERS ON THE FELDER-SILVERMAN LEARNING STYLE TEST

learning by active experimentation (*convergers* and *accommodators*) performed better on their PL-1 ISE. Residents who were *visual* learners on the FSLS (FIGURE 6) scored significantly higher on their PL-1 year ISE. All other analyses revealed no association.

Comparing temperaments to test scores, no statistically significant relationships were found between KTS temperament classification and any of the ISEs or the BCEs. *Artisans* tended to perform better on the ISE, but not in a statistically significant manner (FIGURE 7).

Power Analysis

Using a relatively small effect size ($f^2 = .1$), the research design elicited power ($1 - \beta$ error probability) of .896. Based on this calculation we are relatively certain of our sample's ability to discern effect.²⁰

Discussion

Our findings show that pediatric residents have learning styles and temperaments significantly different from the general population. Bitran and colleagues²¹ compared the choice of medical specialty by medical students to their learning styles and personalities and found that 70% of the medical students that selected pediatrics belonged to the personalities characterized by sensing and judging (similar to the *guardian* temperament), and none were of the sensing-perceiving (*artisan*) personality. This is similar to our results. Also, we found a predominance of *converging* learning styles in pediatric residents, which is consistent with the Kolb⁹ study that shows that medical professionals, in general, tend to be predominantly *convergers*.

Certain learning styles tended to do better in standardized tests than others. Two studies of 227 medical

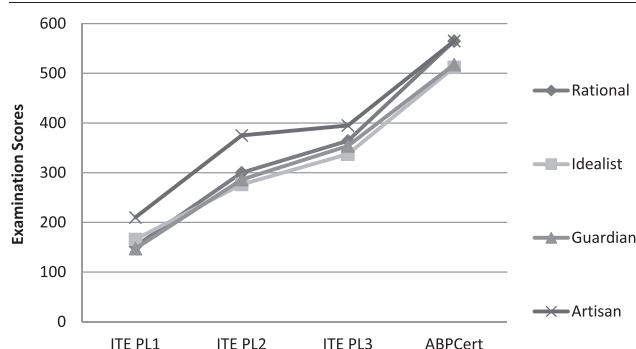


FIGURE 7 | COMPARISON OF KEIRSELEY TEMPERAMENT SORTER TEMPERAMENT STYLES WITH IN-SERVICE TRAINING EXAMINATION AND BOARD CERTIFICATIONS SCORES

students and 16 surgical residents found that the *converger* learning style had better outcomes on standardized testing.^{12,14} This is consistent with our results too. This may be because *convergers* are the thinkers-doers, a learning style that has been shown to perform better on single, best-answer type tests.^{12,22}

Lacorte and Risucci¹¹ and Reich et al¹³ found that the temperaments of anesthesiology and pediatric residents, respectively, correlated with clinical performance during residency. Our study evaluated outcomes of standardized testing, rather than clinical performance and showed no correlation with temperament.

Limitations of our study include its small sample size and single-site intervention. Also, although we had a robust participation rate and included graduated residents, the total number of participants was low because we have an average-sized pediatric residency program. However, power analyses suggest that we had an adequate number of participants for significance. The other potential limitation was that this study was performed within one pediatric residency program. It is possible that the distribution of learning styles and temperaments was not random and could have reflected a selection bias by our faculty when selecting residents. Repeating this study with multiple pediatric residency programs would allow us to further evaluate these results and other hypotheses. Finally, we found that the 2 tests of learning styles did not correlate, which may be due to the small numbers that completed both tests. Having all residents complete the same learning style tool may have led to results with more statistical significance.

Conclusion

Pediatric residents vary greatly, among themselves and across known normative data, in their learning and

temperament styles. Although certain learning styles and temperaments expressed by pediatric residents tended to perform better on standardized tests, they did not consistently predict their performance on in-service and board examinations. Given the variety of learning styles and temperaments in these residents, however, it may be beneficial to augment pediatric resident educational curricula to better reflect the learning styles and temperament of each pediatric residency group.

References

- 1 Accreditation Council for Graduate Medical Education. ACGME program requirements for graduate medical education in pediatrics. http://www.acgme.org/acWebsite/downloads/RRC_progReq/320_pediatrics_07012007.pdf. Accessed July 3, 2010.
- 2 Lowy J. Board certification as prerequisite for hospital staff privileges. <http://virtualmentor.ama-assn.org/2005/04/ccas4-0504.html>. Accessed July 2, 2010.
- 3 Brennan TA, Horwitz RI, Duffy FD, Cassel CK, Goode LD, Lipner RS. The role of physician specialty board certification status in the quality movement. *JAMA*. 2004;292(9):1038–1043.
- 4 American Board of Pediatrics. American Board of Pediatrics board certification pass rates. https://www.abp.org/abpwebsite/stats/abp_esic.pdf. Accessed July 3, 2010.
- 5 Arnold L, Willoughby TL. The empirical association between student and resident physician performances. *Acad Med*. 1993;68(2 suppl):S35–S40.
- 6 Borowitz SM, Saulsbury FT, Wilson WG. Information collected during the residency match process does not predict clinical performance. *Arch Pediatr Adolesc Med*. 2000;154(3):256–260.
- 7 Loftus LS, Arnold L, Willoughby TL, Connolly A. First-year residents' performances compared with their medical school class ranks as determined by three ranking systems. *Acad Med*. 1992;67(5):319–323.
- 8 Gunderman RB, Jackson VP. Are NBME examination scores useful in selecting radiology residency candidates? *Acad Radiol*. 2000;7(8):603–606.
- 9 Kolb AY. The Kolb Learning Style inventory-version 3.1 2005 technical specifications. http://www.learningfromexperience.com/images/uploads/Tech_spec_LSI.pdf. Accessed July 3, 2010.
- 10 Keirsey D. *Please Understand Me II: Temperament, Character, Intelligence*. 1st ed. Del Mar, CA: Prometheus Nemesis Book Company; 2009.
- 11 Lacorte MA, Risucci DA. Personality, clinical performance and knowledge in paediatric residents. *Med Educ*. 1993;27(2):165–169.
- 12 Lynch TG, Woelfl NN, Steele DJ, Hanssen CS. Learning style influences student examination performance. *Am J Surg*. 1998;176(1):62–66.
- 13 Reich DL, Uysal S, Bodian CA, et al. The relationship of cognitive, personality, and academic measures to anesthesiology resident clinical performance. *Anesth Analg*. 1999;88(5):1092–1100.
- 14 Contessa J, Ciardiello KA, Perlman S. Surgery resident learning styles and academic achievement. *Curr Surg*. 2005;62(3):344–347.
- 15 Kolb DA. *Experiential Learning: Experience as the Source of Learning and Development*. 1st ed. Upper Saddle River, NJ: Prentice-Hall, 1984.
- 16 Soloman BA, Felder RM. Index of learning styles questionnaire. <http://chat.carleton.ca/~tblouin/Felder/felder%20silverman%20online%20questionnaire.htm>. Accessed May 16, 2010.
- 17 Keirsey D. Keirsey temperament sorter II. <http://www.keirsey.com/sorter/instruments2.aspx?partid=0>. Accessed May 16, 2010.
- 18 Erdfelder E, Faul F, Buchner A. G*Power: A general power analysis program. *Behav Res Methods Instrum Comput*. 1996;28(1):1–11.
- 19 Pederson A. Understanding ourselves and others: Australian archivists and temperament. In: *Proceedings of the 1999 Annual Conference Archives at Risk: Accountability, Vulnerability, and Credibility*. Brisbane, QSL, Australia: Australian Society of Archivists; 1999. http://www.archivists.org.au/files/Conference_Papers/1999/pederson.html. Accessed August 16, 2008.
- 20 Cohen J. *Statistical Power Analysis for the Behavioral Sciences*. 2nd ed. New York, NY: Academic Press; 1988.
- 21 Bitran M, Zuniga D, Lafuente M, Viviani P, Mena B. Influence of personality and learning styles in the choice of medical specialty [in Spanish]. *Rev Med Chil*. 2005;133(10):1191–1199.
- 22 Cornwell J, Manfredo P. Kolb's learning style theory revisited. *Educ Psychol Meas*. 1994;54(2):317–327.