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Surgical resident learning styles have changed with work hours



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ABSTRACT

Background: The Accreditation Council for Graduate Medical Education instituted the 80-h workweek for residency programs in 2003. This presented a unique challenge for surgery residents who must acquire a medical and technical knowledge base during training. Therefore, learning should be delivered in an environment congruent with an individual's learning style. In this study, we evaluated the learning styles of general surgery residents to determine how learning styles changed after the implementation to the 80-h workweek. **Materials and methods:** Kolb learning style inventory was taken by general surgery residents at the University of Cincinnati's Department of Surgery, and results from 1999–2012 were analyzed. Statistical analysis was performed using the chi-squared, logistic regression and Wilcoxon rank-sum test. Significance was defined as a P value of <0.05 .

Results: A total of 411 responses were obtained from 115 residents. Surgical residents were primarily converging (59.0%) and assimilating (19.1%) learners before 2003. However, there was a shift in predominate learning styles after the institution of the 80-h workweek to converging (43.9%) and accommodating (40.4%, $P < 0.001$). Surgical residents were also more likely to be team-based learners after the start of the 80-h workweek (odds ratio = 2.13, $P = 0.0016$).

Conclusions: After the institution of the 80-h workweek, most general surgery residents remained action-based learners. However, there was a shift within this majority toward a preference for team-based learning. This change paralleled the transition to a more team-based approach to patient care with the implementation of the 80-h workweek. These findings are important for surgical educators to consider in the development of surgical resident curriculum.

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1. Introduction

In July of 2003, the Accreditation Council for Graduate Medical Education (ACGME) instituted the 80-h workweek for all residency programs. The ACGME further reduced resident work hours, particularly those of the intern, in July of 2011. These

changes aimed to address the effects of sleep loss and fatigue on patient care, as well as to provide residents with adequate time for didactic learning and self-education [1]. A number of studies have emerged evaluating the effect of duty hours on patient care and resident education with mixed results [2–6]. These changes present unique challenges for the surgical

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resident who must acquire both a medical and technical knowledge base during their training. In this new learning environment, there is a strong need for surgical educators to maximize the effectiveness and efficiency of resident learning. One strategy to achieve maximal educational effectiveness is to ensure that the learning environment is congruent with an individual's style of learning [7–9].

The Kolb learning style inventory (LSI; Hay Group, Boston, MA) is a reliable and validated self-assessment tool of an individual's learning style [10]. Ideal learning is based on how an individual perceives and processes information. Learning style analysis has been used to evaluate residents and physicians across various medical specialties including internal medicine [11], pediatrics [12,13], anesthesia [14], family medicine [15], and surgery [9,16–18]. However, whether the association between certain learning styles and medical specialties is fixed or fluid remains unclear. In this study, we evaluated the learning styles of general surgery residents to determine if learning styles changed after the transition to the 80-h workweek. We hypothesized that the predominate learning styles among general surgery residents changed concurrently during the same period of duty-hour reform and reflect a broadening of learners entering surgical residency.

2. Materials and methods

The Kolb LSI was administered yearly to categorical general surgery residents at the University of Cincinnati's Department of Surgery. Surgical residents voluntarily completed the inventory by either handwritten or electronic means. Results from the assessment are plotted on a two-dimensional graph based on how an individual perceives information (perception continuum, vertical axis) and processes information (processing continuum, horizontal axis; Fig. 1). Perception of information varies from experiencing interactions or events to developing intellectual constructs such as theories or ideas. This information is then processed by means of either self-

reflection or action [19]. Ideal learning encompasses each of these four different components; however, learners develop preferences for different methods and subsequently develop a preferred learning style [19,20]. Individuals are categorized into one of four different learning styles based on results from the LSI (Fig. 1). Diverging learners learn by observation rather than action; they prefer to gather information from many different sources and consider many different points of view. Assimilators also learn through observation but are less focused on people and more interested in ideas and abstract concepts. They thrive well in the lecture setting and appreciate the knowledge of experts in the field. Conversely, accommodators learn best from experience and collaboration. They are motivated more by doing rather than thinking or listening. Accommodators tend to be risk takers and work best in groups. They rely on their instincts and interactions with others to solve problems. They are therefore more successful in a learning environment that incorporates hands-on activities rather than one that relies solely on lectures. Finally, convergers are action-based learners who limit the involvement of others in their learning process. Convergers like to know how things work using concrete facts. They make decisions based on their own ability to solve problems and prefer not to deal with social or interpersonal issues [21].

Survey results from 1999–2012 were included in the analysis, thereby encompassing general surgery residents who were in training from 1992 and 2012. Residents were divided into two groups, (1) before and (2) after the start of the 80-h workweek instituted by the ACGME on July 1, 2003, based on the year they started residency. Those who started in 2003 were included in the post-2003 cohort. Statistical analysis was performed using the chi-squared test for categorical variables and the Wilcoxon rank-sum test for ordinal variables. Data are presented as *n* and % or as median and interquartile range (IQR). A time-trend analysis was performed using logistic regression, such that learning style trends could be evaluated over the entire study period. A multivariate logistic regression model was constructed to assess changes in resident learning styles after the institution of the 80-h workweek adjusting for resident demographics. All statistical analyses were performed using SAS version 9.2 (SAS Institute, Cary, NC). Significance was defined as a *P* value of <0.05. This study was approved by the University of Cincinnati's Institutional Review Board.

3. Results

3.1. Surgery resident cohort

Learning styles administered to general surgery residents were examined yearly at our institution from 1999–2012. A total of 411 responses were obtained from 115 residents over the 14-y study period (Table 1). Most residents in the study cohort were male (*n* = 89, 77.4%). Surgical residents were predominately converging (50.9%) and accommodating (26.3%) learners over the entire study period, whereas diverging (8.5%) and assimilating (14.4%) learners comprised the minority. A similar number of residents were surveyed before (*n* = 56, 48.7%) and after (*n* = 59, 51.3%) the start of the 2003 duty-hour reform (Table 2). Residents performed a

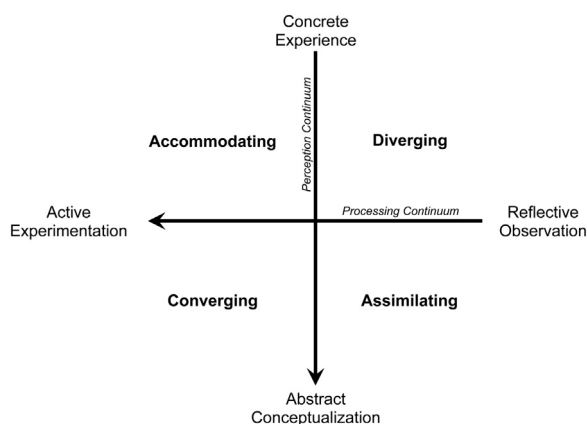


Fig. 1 – Classification of learning styles based on Kolb LSI. The inventory reports how an individual perceives information (vertical axis) and how they process information (horizontal axis) when they learn. The four different learning styles are identified to a specific quadrant.

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