

# How do pediatric surgery residents learn? A sample from Türkiye

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The education of surgeons is as old as human history and has always been of paramount importance. Although modern surgical training started as a master-apprentice model, more effective and efficient education models are needed currently.<sup>[1]</sup> For surgical education to achieve optimal effectiveness and efficiency, it is crucial to consider both the content of the learning material and the methodologies employed in the learning process. The time that surgical residents allocate for research and reading to learn is limited due to their high workload. Therefore, they need to use their available time efficiently.<sup>[1-4]</sup>

Learning styles theory suggests that individuals have different preferences in how they receive, process, and assimilate information.<sup>[5]</sup> The Kolb's Learning Style Inventory (LSI) defines learning as a two-step process of perceiving and processing information. Accordingly, individuals' learning styles form a cyclical process. There are four learning strategies within this cycle: concrete experience (CE), reflective observation (RO), abstract conceptualization (AC) and active experimentation (AE). The ways of learning are also different for each learning style. They prefer to learn through CE by feeling, RO by watching, AC by thinking, and AE by doing. An individual's

## Abstract

**Objectives:** This study aims to determine the learning styles of pediatric surgery residents and develop applicable recommendations for their education based on the obtained data.

**Patients and methods:** The study was conducted as an online survey using Kolb's Learning Style Inventory (LSI) to classify the learning styles of pediatric surgery residents between January 2021 and December 2021. The survey was distributed nationwide to 97 pediatric surgery residents in Türkiye. The form included demographic data (age, sex, year in residency) and Kolb's LSI questions. The LSI consists of 12 questions. The participants were first divided into groups according to their learning styles and sex. Then, to determine the relationship between clinical experience and learning styles, the participants were divided into three groups according to their duration of residency ( $\leq 1$  year [Group 1], 2-3 years [Group 2], 4-5 years [Group 3]).

**Results:** The survey form was sent to 97 residents, with 61 (63%) of them completing the form (25 males, 36 females, mean age:  $28.8 \pm 2.6$  years; range, 24 to 38 years). The most common learning styles among the residents were assimilator and diverger, both equally represented (27.9%). A significant difference was found between sex and learning styles ( $p=0.049$ ), with the divergent learning style more common among male residents (44%) and the assimilator learning style more prevalent among female residents (39%). According to clinical experience, no significant difference was found among the groups ( $p=0.227$ ). The assimilator learning style was more prevalent in senior residents, while the divergent learning style was more common in first-year residents. No significant difference was observed between age and learning styles.

**Conclusion:** The frequent use of divergent and assimilator learning styles among pediatric surgery residents indicates a strong emphasis on theoretical learning and meticulous application of knowledge in practice. Based on our study results, we suggest that pediatric surgery instructors should incorporate more theoretical education into the curriculum to better prepare residents for potential surgical challenges.

**Keywords:** Learning style, pediatric surgery, residency education, training.

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learning style is a combination of these four basic forms, determining their most appropriate learning style. These learning styles are divided into four categories: accommodator, assimilator, diverger and

converger.<sup>[4,6,7]</sup> Therefore, teaching methods can be organized to maximize efficiency by aligning with the learning style of surgical residents.<sup>[8]</sup> These processes are shown in Figure 1.<sup>[9]</sup>

Accommodator learning style uses CE and AE learning strategies. Planning, implementing decisions, gaining new experiences are their main characteristics. These individuals rely on others for information. They act intuitively. They usually work in action-oriented jobs. Diverger learning style includes CE and RO learning strategies. In learning situations, they are patient, objective, make careful judgments but do not act. These individuals like to work in groups, look at situations from different perspectives, are creative and emotional. Assimilator learning style uses AC and RO learning strategy. They focus on abstract concepts while learning. These individuals give more importance to logic and theory. They like reading and lecturing and have less interaction with others. They usually work in applied sciences and research departments. Converger learning style encompasses AC and AE learning strategies. Problem

solving, decision making and planning are their main characteristics. These individuals are relatively emotionless, more interested in things than others, and are hands-on learners.<sup>[10]</sup>

In the literature, there is a limited number of studies on the learning styles of surgical residents, and there is no specific study on the learning styles of pediatric surgery residents.<sup>[1-5]</sup> In the present study, we, therefore, aimed to determine the learning styles of pediatric surgery residents and to develop applicable recommendations for pediatric surgery resident education with the purpose of bridging the gap in this field.

## PATIENTS AND METHODS

This cross-sectional study was conducted at Ankara Yıldırım Beyazıt University, Department of Department of Pediatric Surgery between January 2021 and December 2021. A written informed consent was obtained from each participant. The study protocol was approved by the Ankara City

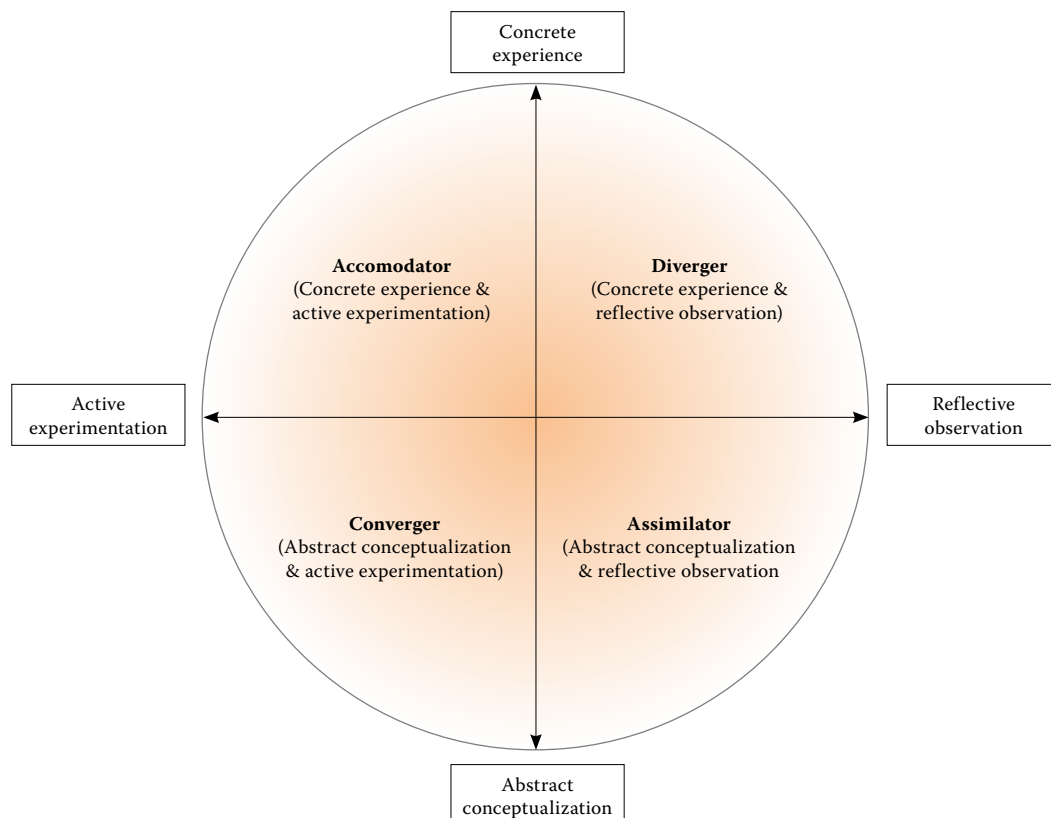


Figure 1. Kolb's cycle of learning.<sup>[9]</sup>

Hospital No. 1 Clinical Research Ethics Committee (date: 19.08.2020, no: E1/962/2020). The study was conducted in accordance with the principles of the Declaration of Helsinki.

The data collection instrument was constructed using Google Forms. It was sent online to a total of 97 pediatric surgery residents nationwide, requesting them to complete the form. The form included demographic data (age, sex, year in residency) and Kolb's LSI questions. The LSI consists of 12 questions. In each question, the participants are asked to rank from one to four the options that are closest to them from the four options. Total scores for each of the four elements of the learning process (AE, CE, RO and AC) range from 12 to 48 point. Using a cartesian graph, the value found by subtracting RO from AE is marked on the x-axis and the value found by subtracting CE from AC is marked on the y-axis. The point of overlap is marked on the Cartesian graph of both values. This point indicates which learning style the participant is in.

The participants were first divided into groups according to their learning styles and sex. Then, to determine the relationship between clinical experience and learning styles, the participants were divided into three groups according to their duration of residency ( $\leq 1$  year [Group 1], 2-3 years [Group 2], 4-5 years [Group 3]). The groups were compared, and it was analyzed whether there was a difference between them.

### Statistical analysis

Statistical analysis was performed using the IBM SPSS version 25.0 software (IBM Corp., Armonk,

NY, USA). Continuous variables were expressed in mean  $\pm$  standard deviation (SD) or median (min-max), while categorical variables were expressed in number and frequency. It was checked whether the continuous variables were normally distributed. Since they were normally distributed, analysis of variance (ANOVA) was used to compare the groups. The Pearson chi-square and Fisher exact tests were used to analyze categorical variables. A  $p$  value of  $<0.05$  was considered statistically significant.

## RESULTS

The survey form was sent to 97 residents, with 61 (63%) of them completing the form (25 males, 36 females, mean age:  $28.8 \pm 2.6$  years; range, 24 to 38 years). Demographic data of the participants are shown in Table 1. The most common learning styles among the residents were assimilator and diverger, both equally represented (27.9%).

A significant difference was found between the sex of the residents and their learning styles ( $p=0.049$ ). The divergent learning style was more common among male residents (44%), while the assimilator learning style was more prevalent among female residents (39%). The learning styles of the residents according to their sex are shown in Table 2.

According to clinical experience of residents, no significant difference was found among the three groups ( $p=0.227$ ). However, the assimilator learning style was more prevalent in Group 3 with more clinical experience, while the divergent learning style was more common in Group 1 with less clinical experience (Table 3).

	n	%	Mean $\pm$ SD	Min-Max
Age (year)			28.8 $\pm$ 2.6	24-38
Sex				
Female	36	59		
Male	25	41		
Resident year				
First	25	41.0		
Second	5	8.2		
Third	10	16.4		
Fourth	8	13.1		
Fifth	13	21.3		
SD: Standard deviation.				

TABLE 2							
Learning style by sex							
	Female		Male		Total		<i>p</i>
	n	%	n	%	n	%	
Diverger	6	17	11	44	17	27.9	0.049*
Accomodator	8	22	5	20	13	21.3	
Converger	8	22	6	24	14	22.9	
Assimilator	14	39	3	12	17	27.9	

\* Chi-Square test used.

TABLE 3				
Learning styles by groups				
	Group-1	Group-2	Group-3	<i>p</i>
	n	n	n	
Diverger	9	2	6	0.227*
Accomodator	4	7	2	
Converger	6	3	5	
Assimilator	6	3	8	

\* Chi-Square test used.

TABLE 4				
Learning styles by resident ages				
	n	Mean±SD	Min-Max	<i>p</i>
Diverger	17	29.00±1.97	28-30	0.803*
Accomodator	13	28.38±3.20	26-30	
Converger	14	28.57±1.95	27-30	
Assimilator	17	29.24±3.11	27-30	

SD: Standard deviation; \* ANOVA test used.

There was no significant difference between the learning styles of the participants and their ages. However, the mean age of the residents who preferred assimilator style was higher than the others ( $p=0.803$ ). The relationship between learning styles and age is shown in Table 4.

## DISCUSSION

In the present study, we evaluated the learning styles of pediatric surgery residents, revealing that the most common learning styles were assimilator and diverger. The predominant use of divergent

and assimilator learning styles among pediatric surgery residents suggests a strong preference for theoretical learning during their training, which they carefully integrate into practical applications. The assimilator learning style helps learners understand abstract concepts by analyzing their observations. The diverger learning style enables learners to create new concepts from practical experiences by analyzing concrete situations. Surgical residents benefit professionally from a combination of learning styles. This multifaceted approach enables surgical residents to be competent in both practical skills and theoretical knowledge.<sup>[11]</sup>

Numerous studies have yielded controversial results concerning the correlation between learning styles and sex differences.<sup>[2,12,13]</sup> On the other hand, there are also many studies showing that sex has no effect on learning styles.<sup>[14-16]</sup> Our findings revealed a statistically significant correlation between sex and preferred learning styles among the pediatric surgery residents surveyed.

Individual learning styles have been shown to evolve during the transition from medical school to residency, specialty training, and subsequent professional development stages.<sup>[2,17]</sup> The predominance of the assimilator learning style among the more experienced residents in Group 3 suggests that, as clinical experience accumulates, there is a heightened focus on understanding theoretical knowledge and abstract concepts. The assimilator style, which prioritizes the analysis of complex situations and the comprehension of abstract theories, may become increasingly relevant as residents advance in their training. However, this finding is somewhat unexpected, as it is typically anticipated that more experienced surgeons would transition toward a more active, experiential learning style. Nevertheless, it is plausible that these residents prefer the assimilator style as a means to better integrate and solidify their practical experiences with a strong theoretical foundation. This preference may arise from the need to fully grasp the intricate surgical techniques and theoretical knowledge encountered during the later stages of their training. Consistent with this, our study found that the assimilator learning style was more prevalent among senior residents, whereas first-year residents predominantly exhibited the diverger learning style. Furthermore, previous studies have demonstrated no significant difference between learning styles and participant age.<sup>[16,18]</sup> Our study also found no significant difference age and learning styles.

Review of the literature reveals studies showing that there is a relationship between learning style and choice of specialization in medicine.<sup>[19]</sup> This indicates that individuals with similar learning styles prefer similar specialties. There are studies on residency programs showing that a learning style characteristic of the specialty preferred by the individual is dominant.<sup>[19,20]</sup> A study on internal medicine training found that the assimilator learning style was most common, while another study involving general surgery residents found a

57% prevalence converger learning style. Among ophthalmology residents, the assimilator learning style was most common.<sup>[2,16,21,22]</sup> A study on pediatric residents noted a high prevalence of the converger learning style.<sup>[23]</sup> In our study, the most common learning styles were diverger and assimilator styles.

Learning styles across different medical specialties can vary significantly from one country to another, influenced by national education systems and cultural factors. In countries where theoretical training is prioritized, certain learning styles may predominate. In contrast, in nations that emphasize practical, hands-on training, more active learning styles are likely to be prevalent. These variations can have a profound impact on the learning styles adopted within surgical specialties. Ensuring alignment between a resident's learning style and the structure of the training program is crucial for optimizing resident performance.<sup>[20]</sup> Therefore, tailoring the pediatric surgery curriculum to better align with these predominant learning styles may enhance educational outcomes.

The limitations to the study include the relatively small number of pediatric surgery residents in Türkiye and the inability to reach all of them. More reliable and generalizable results can be obtained by reaching a larger participant group.

In conclusion, the frequent use of divergent and assimilator learning styles among pediatric surgery residents indicates that they value theoretical learning during their training period and meticulously apply this knowledge in practice. Based on our study results, we suggest that pediatric surgery instructors should incorporate more theoretical education into the pediatric surgery residency curriculum to better prepare residents for potential surgical challenges.

**Data Sharing Statement:** The data that support the findings of this study are available from the corresponding author upon reasonable request.

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