Virtual histology laboratories (VHLs) are increasingly used in histology and pathology courses in medical, dental, and graduate curricula across North America. With technological advancements, there is the opportunity to track the learning process to achieve histology competency. The objective of the study was to quantitatively elucidate how learning takes place specifically in a visually oriented subject such as histology. Therefore, first-year graduate students enrolled in histology course were recruited. Using an eye-tracking device, the recruits’ eye-movements, task-based, and fixed interactions with virtual tissue slides on an existing VHL program were recorded and analyzed for emerging patterns across time and evolving level of expertise. The same data points were collected for five, second-year students who completed the course a year ago, and three histology experts for comparison. The results show that at first-year students decreased the amount of time it took to identify a tissue and demonstrated increase in pattern recognition skills as the course progressed. With increasing skills, the eye-movement patterns of the first-year students approached those of the experts. Quantitative analyses reveal that expert level of pattern recognition skills were characterized by longer saccadic movements over key areas of interest and overall, faster determination on tissue identity. By extracting key areas of interest and elucidating a quantitative pattern of the most effective way of approaching histological tissues, future students may benefit from implementing the evidence-based approach presented.

**Methods**

**Study Participants:** 14 first-year graduate students (MS1) enrolled in introductory human histology course, 5 second-year students (MS2) who previously took the same course, and 3 experts in the field of pathology and histology were recruited to participate in the study.

**Experimental Design:**
- 12 unknown virtual tissue slides on LeesHistology.com
- Two eye-tracking measurements per slide using Gazepoint™
- Active Identification Quiz
- Passive Identification Quiz

**Analysis:** Among the first-year students, linear mixed model regression analyses were used to compare the outcome variables of interest across the three study phases. Due to the small number of experts and second-year students, it was not possible to test for differences in the primary outcome variables between students, experts, and second-year students.

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