Learning Styles of Orthopaedic Residents and Their Performance in the Orthopaedic In-Training Examination

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Abstract

The success of a training programme hinges on the performance of their residents. Trainers and learners need to adapt to rapid advancement of medical knowledge and technology coupled with training requirements such as research and duty hour restrictions. An understanding of the learning style preferences may be helpful for both trainers and learners.

In this study we evaluated the orthopaedic resident learning styles and hypothesised that the read/write dominant learning styles is associated with better OITE scores.

The Fleming VARK learning styles questionnaire was administered to orthopaedic residents at a single centre in 2017. Their OITE scores and yearly faculty review of performance were analysed for association with their learning styles.

All residents (n=22) completed the questionnaire. All but one resident had quad-modal preference for learning. 45% of the trainees were kinaesthetic dominant, 32% read/write dominant and 27% visual dominant and 18% aural dominant. Aural dominant learners had highest average OITE scores followed by kinaesthetic dominant learners.

Our residents showed multimodal preferred learning style with most of our residents being kinaesthetic dominant. Trainers and learners may consider incorporating a greater number of teaching activities that suit their individual learning styles to enhance their learning efficiency.

Keywords: Learning; Resident Education; Curriculum Development; OITE
Introduction

Orthopaedic residency training programmes prepare and deliver orthopaedic surgeons who are equipped with the knowledge and technical skills within a fixed period of time. The increasing body of medical knowledge, surgical innovation, duty hour restrictions, research requirements are examples of pressures for both teachers and learners in current training programmes. The quality of a residency programme hinges on the performance of their residents. There is interest in being able to deliver efficient teaching and adapting teaching methods to individual learning styles.

Several studies show that learners have distinct learning styles (Andrassy and Torma, 1982), (Quillin et al., 2013). There are a number of models of learning styles and the VARK model is a validated questionnaire developed by Fleming in 1987 (Leite, Svinicki and Shi, 2010). This model categorises learners as visual (V), aural (A), read/write (R) kinaesthetic (K) or multimodal (M) learners. The VARK learning style preferences of orthopaedic residents have not been previously evaluated. A learner can prefer a single dominant modality, or have a preference for a combination of modalities. In this study, we conducted a survey based on the VARK questionnaire amongst our orthopaedic residents from year two to year six in the National University Hospital of Singapore (n=22), and correlated their learning styles with the Orthopaedic In-Training Examination Score (OITE) in 2016, as well as their 2016 year-end performance assessments. Given that this is a written examination, we hypothesised that read/write dominant learning styles is associated with better OITE scores.

Methods

The sample population of this study involved all Orthopaedic residents from year two to year six from the National University Hospital of Singapore residency programme who had taken the OITE examination in 2016. Year one trainees were not required to take the OITE and excluded from the study. Following Institutional Review Board approval, the residents were sent an invitation by e-mail to participate in the study. Participation was voluntary and informed consent was obtained. A second email was then sent and the Fleming VARK learning styles questionnaire (version 7.1) was administered. Participants were informed that they could choose more than a single answer for each of the questions. Their OITE scores for the year of 2016 and overall year-end assessment by faculty were extracted from the training program director.

Other data collected included age, sex, post graduate year and year in residency. The resident’s name was required as an identifier on the questionnaire for pairing with their results.

One researcher collected the scores of the VARK questionnaire and determined the preferred learning style. Residents were categorised as having preferences for visual (V), aural (A), read/write (R) or kinaesthetic (K) learning styles. The residents were also categorised as having a preference for single or multimodal learning. The results were then handed to the second researcher who paired it with the residents’ OITE scores and year end assessments prior to anonymising the results. The paired anonymised results were then handed to the third researcher who performed the data analysis.

The data was analysed using the student t-test, analysis of variance and Pearson correlation tests with a p value less than 0.05 deemed significant.

Results/Analysis

All 22 residents (100%) from year two to year six of the residency participated in the study. One resident did not
have OITE scores recorded for the year due to medical illness and was excluded from final analysis. There were 2 female and 19 male residents. All of our residents demonstrated a preference for multimodal learning. 95% of residents were quad-modal and only 5% (n=1) demonstrated a trimodal preference (R,V,A).

The prevalence of the dominant learning style is represented by the bar chart below (Figure 1). The sum of the modalities exceed 100% as most of our residents have a more than one dominant learning preference and were counted more than once. 45% of the trainees were kinaesthetic dominant, 32% read/write dominant and 27% visual dominant and 18% aural dominant.

The senior residents (year four, five and six residents) had higher OITE scores (p=0.003). (A) dominant learners had highest average OITE scores followed by (K) dominant learners. The (R) dominant learners had the lowest average OITE scores (Figure 2).

There is a moderate correlation between kinaesthetic learning style with their OITE scores (r=0.50) (Figure 3). Residents who had kinaesthetic learning styles had superior year end performance assessment (r=0.51, p=0.033). There was no statistical difference between the senior and junior residents when it came to the yearly performance assessment.

**Figure 1:** The prevalence of the VARK learning styles amongst residents. The residents had a multimodal preference for learning as such the total number exceeds the number of residents in the study.

**Prevalence of learning style modalities**
Figure 2: Resident dominant learning style and their OITE scores are reflected in the chart below.

![Chart showing learning style and average OITE score](chart.png)

Figure 3: Correlation between the kinaesthetic learning style with the performance of residents in the OITE.
Discussion

Learning styles or preferences have been defined as an individual's preferred way to learn or the way that they learn best (Kocinski, 1984). It is also the individual's unique way of interacting with the environment. Learning style is complex way in which individuals are able to perceive, process, store and recall information (James and Gardner, 1995). In health care curricula, gender, culture, and specific specialties are factors that affect learning styles (Breckler, John and Ngo, 2009), (Nuzhat et al., 2011), (James, D’Amore and Thomas, 2011), (Murphy et al., 2004).

Traditional medical training relied on a variety of methods from didactic lectures, reading programmes, problem based learning and hands-on experience. However, the modern delivery of teaching faces challenges of duty hour restriction, increased number of residents, need for research productivity and the rapid advances in medical knowledge during a finite period of training. Understanding learning styles may be important in developing an effective training programme. Perhaps more importantly, when teaching methods are adopted to learning styles, learner motivation can be improved and this may reduce attrition rate from training programmes.

The quality and the success of a residency programme is often measured by the performance of their residents. One such assessment is the Orthopaedic In Training Examination which was one of the first intraining examination administered for any specialty (Marsh, Hruska and Mevis, 2010). This test is administered electronic to orthopaedic residents whose programmes subscribe to it internationally. It is a tool for assessing knowledge and correlates to the performance with passing the American Board of Orthopaedic Surgery (Swanson et al., 2013), (Dougherty et al., 2010), (Herndon, Allan and Dyer, 2009). Singapore adopted the residency programme in 2011 which was a change from the previous UK based training system. The National University Hospital orthopaedic residency programme is an ACGME accredited programme and accepted their pioneer batch of residents in 2011. We embarked on this
survey in 2016 as we had 5 different batches of residents and believed that it was timely to reflect on this new training programme.

The VARK model is an easy available model that classifies learning styles into the various sensory modalities i.e. visual, aural, read/write and kinaesthetic. When administered online, results can be obtained immediately after completion. This model has been validated (Leite et al., 2010) but has not been applied to orthopaedic residents.

The VARK questionnaire has been used to explore learning preferences and academic performance amongst health care students. This has revealed fairly interesting and conflicting results. For example, the K dominant learning preference is a positive predictor of academic performance in clinically based, hands-on training programmes for a group of nursing students (Koch et al., 2011) in contrast with a group of K dominant physiology students who performed poorly (Dobson, 2009). The A dominant learners performed best in a group of dental biostatistics/research course where lecture attendance was required for the final exam (El Tantawi, 2009). These suggest that academic success may be greater for those whose learning preferences match a significant component of the course. Others however have shown no association between learning preference and academic results reflecting the complexity of student learning styles (Dobson, 2009), (Urval et al., 2014).

In our study, all our residents have a multimodal learning preference matching the results for the general population of VARK respondents. Half of our residents have a kinaesthetic dominant learning style. In fact only 1 resident had learning preferences that did not include a kinaesthetic component. This is higher than the 31.9% of the general population of VARK respondents who had a kinesthetic component in their preferences. This is a reflection of the hands-on nature in the surgical field. Kim et al., studied a group of general surgical residents and found that 67% their residents had a degree of K learning preference (Kim, Gilbert and Ristig, 2015). This is in contrast to 95% of the orthopaedic residents in our programme who had a K learning preference. This is interesting as the orthopaedic field is fairly reliant on manual handling of fractures, joints, and the use of implants, orthotics and prosthesis in their daily practice. A higher number of kinaesthetic learners as compared to the general surgical residents is perhaps explained by that. Another interesting result comparing our results with that of Kim is that their R dominant residents did better in their in training examination whereas our R dominant residents performed worst. Our residents with dominant Aural learning style did best in their in training exam followed by the dominant K learning style whilst the A learning style in Kim’s study showed worst in training examination results. Transmission of knowledge to orthopaedic residents are perhaps best with techniques where residents are given auditory instructions and allowed to manipulate materials or objects such as through use of models, simulation and participation in demonstrations. It is possible to tailor the distribution of each teaching methods to suit the target group of residents.

For the resident who is looking to improve their in training examination scores, both learner and their trainers can look into incorporating a greater number of teaching activities that suit their individual learning styles to enhance their learning efficiency.

There are some limitations to our study. The study is a single centre study with a small sample size. This may have led to type II error during the data analysis. Our residents also come from a diverse background in terms of age, clinical experience and ethnicity. Our aim nonetheless is not to label our orthopaedic residents based on their learning styles but rather to highlight the need to be fluid and modify residency curriculums to tailor to the needs of their residents. More studies are needed to determine if modifications based on learning styles are successful in improving resident intraining examination results.
Conclusion

Our residents exhibit a multimodal preferred learning style with most of our residents being kinaesthetic dominant. Trainers and learners could look to improve OITE scores of residents who are struggling by understanding their preferred learning methods and engaging individualised teaching methods.

Take Home Messages

- Orthopaedic residents exhibit a kinaesthetic dominant learning style.
- Residents who performed better at the OITE had an Aural dominant learning style.
- Understanding the learning styles of residents may help improve their OITE performance.

Notes On Contributors

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Acknowledgements

Figures 1-3. Source: the authors. All figures have not previously been published elsewhere.

Bibliography/References


Appendices

None.

Declarations

The author has declared that there are no conflicts of interest.

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Ethics Statement

Our study was approved by the National Healthcare Group Domain Specific Review Board (DSRB) under Domain F (Education Research) category. Reference number 2017/00158. All participants signed informed consent forms.

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