HOW SURGICAL RESIDENTS LEARN: LEARNING STYLE PREFERENCES AND HYBRID SCIENTIFIC CONFERENCE ENGAGEMENT

A Scholarly Research Project

Submitted in Partial Fulfillment of the Requirements for the Degree

Doctor of Education

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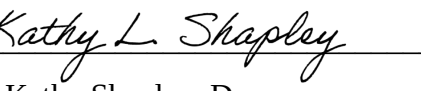

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May 2025

ABSTRACT

Surgical resident learning style preferences in the wake of the rapid, widespread adoption of online learning technology during and following the COVID-19 pandemic is not widely studied. This study investigated learning style preferences of surgical residents in the context of engagement in a hybrid national scientific conference. Thirty-five surgical residents completed the Kolb Experiential Learning Profile (KELP) prior to attending the conference. Afterward, 26 completed a mixed methods survey. Login data were reviewed for online activity for all participants. Ninety-six percent of participants attended the conference in person and zero attended virtually only. Residents indicated focused time for learning and engaging with colleagues were most beneficial to their learning. Eighty-four percent were satisfied with the educational content provided. Results showed that 23% had an Acting learning style followed by Deciding at 20% and Balancing at 14%. Seventy-seven percent thought their KELP results were accurate and largely reinforced their existing learning approaches. Sixty-nine percent thought it would be helpful in their training while 84% thought it would be helpful in future professional development. Fifty-six percent planned to engage online, however only 7.7% did so, indicating the self-identified barrier of time prevented online engagement in education. Despite the small sample size, relationships between learning style and age and self-reported program size approached significance. Dedicated in-person learning is still effective and worthwhile for these learners. Experiential learning approaches may make in-person learning more impactful and microlearning may increase online engagement.

ACKNOWLEDGMENTS

I would like to thank first and foremost my husband, John, and my son, Jackson, without whose unwavering support and understanding this would not have been possible. Thank you to my mom who is my first and best role model. I'm grateful to my friends and family who supported and encouraged me along the way.

Thanks to Dr. T. Scott Estes and Dr. Jeffrey P. Bakken at Bradley University for their support and guidance throughout this journey. Thanks to my ACS colleagues who inquired about my research and supported me, including Dr. Ajit Sachdeva. Thank you to Dr. Alisa Nagler, a mentor in this process, whose guidance was immensely helpful at every turn. Lastly, tremendous thanks to my colleague and dear friend who took this journey with me, Dr. M. Jane Burns.

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CHAPTER 1: INTRODUCTION

Introduction

While the effect of the coronavirus disease 2019 (COVID-19) pandemic was profound, one of the most ubiquitous situations encountered during that time was the almost instant shift to videoconferencing with others from the comfort of your home. The pace with which almost all interaction immediately switched to digitally mediated means, like Zoom, was staggering, and was necessitated by the unprecedented situation the world found itself in 2020, trying to combat a novel, highly transmissible virus. Almost every industry was impacted by this rapid technological shift, including surgical education. Surgical residents were uniquely impacted as the pandemic occurred at critical times during their training (Ellison et al., 2020).

Literature abounds in the area of surgical education, including the study of the application of learning style preference. While much of that focus to date examines the relationship between surgical residents' learning style preferences and objective outcomes, such as standardized exam performance (Kim et al., 2015, 2018), the relationship between resident learning style preference and educational activities is not well investigated. This chapter introduces the research problem, including background information framing the need for the study, and an introductory discussion of the context of the COVID-19 pandemic, hybrid learning, and learning style preferences. The chapter goes on to articulate the purpose of the study, the study's research question, and the definitions and assumptions that will guide the study. The chapter closes with a discussion of the study's significance and a brief description of how the five-chapter research report is organized.

Background Information

Professional medical associations bring together healthcare professionals around a similar area of interest to learn and network. Some of the oldest were established over 100 years ago

(American College of Surgeons, n.d.-a). They frequently host annual meetings, which are large scientific conferences that bring together healthcare practitioners at various levels of training. (American College of Surgeons, 2022). Like much of the world, educational engagement shifted to virtual methods during the COVID-19 pandemic. Some of these types of conferences shifted to completely virtual meetings in 2020 and 2021 (American College of Surgeons, n.d.-b). Following the pandemic, these kinds of meetings settled on a hybrid format where participants could experience education in person, online, or both.

Statement of the Research Problem

Research Problem

With the rapid adoption of virtual and hybrid meeting modalities necessitated by the COVID-19 pandemic, there is little information known about the relationship between surgical residents' learning style preferences and their engagement with educational content in the context of a hybrid national scientific conference.

Background Information and Context

The context of the COVID-19 pandemic and its effect on surgical training, a primer on hybrid learning, and a background on learning style preferences will form the research basis for this study.

COVID-19 Pandemic and Its Effect on Surgical Training

The COVID-19 pandemic had a profound effect on how surgical training was conducted and it is critical to understand that shift in the overall context of what many healthcare providers in general, and surgical residents in particular, were experiencing.

In March 2020, guidance was issued recommending cancellation of elective procedures to reduce the risk of transmission of COVID-19 (American College of Surgeons, 2020). This,

aligned with Centers for Disease Control and Prevention guidance which impacted operative volume for residents to obtain their necessary case experience and the expected progression of trainees in their programs (Ellison et al., 2020). Surgical residents were uniquely impacted as the pandemic occurred at critical times during their training. (Ellison et al., 2020). Basic equipment, such as personal protective equipment (PPE), was inconsistently available (Abdelsattar et al., 2021, Dedeilia et al., 2020). While this disruption decreased in the 2020-2021 academic year, it was not completely eradicated (Ellison et al., 2022a). Advancing to the next year in training was also impacted, as reported by approximately 20% of programs, where adjustments in the curriculum were needed to keep residents on track (Ellison et al., 2022a).

More routine procedures that surgery residents are often able to perform with some measure of autonomy were largely affected by case cancellation. Residents were necessarily deployed to areas with greater need, however, that was at odds with their intended course of study. The lack of available PPE prevented non-essential personnel from entering operating rooms, also contributing to a lack of experience during this time (Dedeilia et al., 2020). Many surgical specialties were impacted by these challenges, from oral and maxillofacial surgeons (Huntley et al., 2020) to vascular surgeons (Mouawad et al., 2021), with over 90% of elective procedures cancelled.

The COVID-19 pandemic also necessitated a rapid shift in the traditional approaches to surgical education. Technologies were quickly adapted to meet educational needs without the benefit of the usual educational planning processes (Terhune et al., 2020). This impacted surgical training (Ellison et al., 2020) and similarly impacted in-person scientific conferences, most of which were shifted entirely online (Terhune et al., 2020; Vervoort et al., 2021), and eventually to hybrid meetings as a return to in-person meetings occurred.

Some of the cited successes in the surgical education literature included a switch from in-person to virtual education and videoconferencing (Abdelsattar et al., 2021; Dedeilia et al., 2020). For example, during six focus groups conducted with general surgery residents, Abdelsattar et al. (2021) indicated that residents reported improvement in the quality of didactic learning with an increased diversity of speakers afforded by a virtual platform delivery. The utilization of distance education and hybrid learning technologies during the pandemic may be one lasting change in surgical education.

Hybrid Learning

Alternatives to in-person instruction have been around in one way, shape, or form, for decades. With the relatively recent widespread adoption of hybrid meeting technology as applied to conferences, research in the area is developing. Hybrid learning as it pertains to the classroom environment has been studied more extensively and both applications will be discussed below.

Despite the rapid widespread adoption of distance/hybrid technology for education in a new environment, such as surgical education as necessitated by the pandemic, there is empirical evidence of its efficacy, or even superiority, to traditional classroom instruction (Bird et al., 2020; Hew & Lo, 2018; Schaber et al., 2010). In a quantitative study, Bird et al. (2020) found that learners had the highest rate of planned behavior change after engaging in education using a blended learning format. In a survey conducted by Schaber et al. (2010), when comparing classroom and blended formats, students in the blended format had a perception of better content understanding than those in the traditional classroom approach. Hew and Lo (2018) found that academic performance actually improved in a blended learning model as compared to that of a traditional classroom.

Hybrid and blended learning are areas of investigation across surgical specialties including orthopaedic surgery (Thompson et al., 2022), neurosurgery (Acaroglu et al., 2022), and oral and maxillofacial surgery (Bock et al., 2018). Thompson et al. (2022) conducted a literature review inclusive of over 1,500 orthopaedic surgery residents and medical students and found that a combination of approaches including virtual, distance, and in-person learning would increase knowledge retention. Acaroglu et al. (2022) conducted a mixed methods study evaluating a blended course using pre- and posttests as well as login information and surveys. They found high satisfaction and significant learning occurred with asynchronous instruction.

Literature in surgical education explains that in order to effectively train surgeons, an understanding of how they learn is crucial (Sachdeva et al., 2021; Richard et al., 2014). Researchers have also found a statistically significant difference in learning style preference between medical students and both residents and faculty, which they concluded, could impact future education (Engels & de Gara, 2010). An investigation into learning style preferences follows.

Learning Style Preferences

People optimally assimilate information in different ways. This has been investigated over time with dominant theories established by many, including Knowles, Kolb, and Fleming. Malcolm Knowles (1970) was a pioneer in the 1970s suggesting that adults learn differently than children. This model of andragogy identifies core principles of adult learning, which may differ based on the individual learner, the specific situation, or even the subject matter (Knowles et al., 2014).

Kolb's (1984) Experiential Learning Theory (ELT) posited that a learner's experience impacts their learning, and this is not only limited to life experience, but also the cycle of

reflection, analysis, and experimentation that accompanies it. Derived from ELT, was the Kolb Learning Style Inventory (LSI) which aims to categorize learners based on their preferences in assimilating and processing experiences. As described by Kolb and Kolb (2005a), the ELT model operates on the cycle of interaction between two axes of understanding and translating experience. The combination of these tendencies, and the preferences toward using certain ones more frequently, can be defined as a learning style. When reviewed independently by Kayes (2005) in a study with 221 students, they found the inventory showed internal reliability and validity. The most recent version, the Kolb Experiential Learning Profile (KELP), was released in 2021.

Similarly, Neil Fleming (1995) introduced a model of learning style based more on how information is delivered, rather than on how it is processed. The VARK model categorizes learners based on a preference for visual, aural, read/write, or kinesthetic information presentation.

Learning Style Preferences as Applied to Surgical Fields

Previous research has primarily investigated the relationship between surgical residents' learning styles and objective outcomes such as standardized exam performance (Kim et al., 2015, 2018). Kim et al. (2015) used the responses to the VARK inventory by 56 surgery residents over a two-year period to a standardized exam and found the majority (51%) had a multimodal style, and those who had a read/write style had higher exam scores. In a later study, Kim et al. (2018) conducted a multi-institutional study, again using the VARK inventory and a standardized exam, and found that those who had aural style had higher exam scores and that overall, the 132 participants had statistically different distribution of VARK styles when compared to the population in general.

General surgery is not unique to this inquiry; other surgical specialties have investigated the insights learning style preferences may provide including orthopaedic surgery (Richard et al., 2014), neurosurgery (Lai et al., 2014), and plastic surgery (Saldanha et al., 2019). It is worthy to note that the three above mentioned studies all utilized the Kolb LSI.

Richard et al. (2014) used the Kolb LSI to review the learning style preferences of 71 orthopaedic residency applicants, residents, and faculty members. They found a majority had a Converging style (53.5%). Lai et al. (2014) evaluated 81 neurosurgeons, neurosurgery residents, and neurology residents across three sites. They found a preference for Assimilating and Diverging styles. Saldanha (2019) administered the LSI to 45 plastic surgery residents across three programs and found a varied combination of styles, rather than one dominant style.

Richard et al. (2014) and Lai (2014) however both found that the Assimilating learning style became more prevalent with age. Engels and de Gara (2010) utilized the LSI and similarly found a statistically significant difference between the learning style of medical residents and both residents and faculty, however in this study, the medical students exhibited an Assimilating style as compared to residents and medical students.

Challenges to Learning Style Preferences

While there has been much research devoted to investigating learning styles, clear evidence of their validity is still lacking (Cuevas & Dawson, 2018). Even as evidenced above, some findings are contradictory. While a variety of factors undoubtedly impact how well a learner acquires knowledge in a given situation, one could argue that any insight into how learners absorb knowledge would be helpful in better designing educational interventions to improve learning.

Despite investigation into learning styles, there is little research on the relationship between resident learning style preference and engagement in educational activities, like a hybrid scientific conference.

Synthesis of the Research Problem

Residents are an important population of study as they will eventually become practicing surgeons and engage in decades of continuing professional development. Understanding their learning styles and preferences will not only help them identify opportunities best aligned to their learning style but can also potentially inform development of future educational activities. This group is little studied in this context. Ellison et al. (2020) reported virtual conferences were adopted by 97% of training programs during the COVID-19 pandemic. With the rapid adoption of virtual and hybrid meeting modalities as a result of the pandemic, planning and research was not available.

In this study, surgical resident attendees at a national scientific conference took a validated learning styles inventory and confidential survey on professional development content delivery preferences. This information was compared to meeting attendance and educational program access information. This action research project studied surgical residents' learning style preferences and the relationship with engaging with educational content in the context of a hybrid national scientific conference.

Research Purpose and Question

The purpose of this study was to uncover surgical residents' learning style preferences and illuminate how they engaged with educational content in the context of a hybrid national scientific conference.

The study was guided by the following research question: What is the relationship between surgical residents' learning style preferences and their engagement with educational content in the context of a hybrid national scientific conference?

Definitions and Assumptions

For the purposes of this study, the following definitions are used: Continuous professional development—"Continuous professional development focuses on the individual learning needs of physicians across the continuum of their professional careers and encompasses a broad range of educational activities" (Sachdeva, 2005, p. 264).

Hybrid or blended learning—The terms hybrid and blended learning are often used interchangeably. However, consensus is that hybrid learning "include[s] some aspect of face-to-face learning and online learning" (Hrastinski, 2019, p. 564).

Learning style preference—Kolb and Kolb (2005a) define a learning style as "individual differences in learning based on the learner's preference for employing different phases of the learning cycle" (p. 194–195). That learning cycle includes the understanding and processing of experiences. As this is not known to be a fixed trait, but can change, the term learning style preference is used.

Surgical resident—"Residents are doctors who have completed medical school. Residents are training in a surgical specialty." (American College of Surgeons, n.d.-c).

As surgical residents are younger in age and are generally technologically savvy, it is assumed that there will be preferences toward technologically mediated instruction and asynchronous availability of educational content.

Significance of the Study

Residents are an important population of study as they will eventually become practicing surgeons. Understanding their learning style preferences and engagement will help them identify opportunities best aligned to their learning style and can potentially inform development of future educational activities (Engels & de Gara, 2010; Saldanha et al., 2019).

This study will contribute to the body of knowledge in the field by investigating surgical residents in a context that is frequently overlooked. This population is often investigated in terms of their primary learning environment, however, a connection into a new learning environment, one in which they will spend the majority of their careers, can offer tremendous value and insight into their preferences. This study can provide additional insight into the ambiguous field of learning style preferences. The results can benefit not only the residents themselves, but also surgical residency program directors, surgical educators, and those administering continuing professional development for surgeons.

Organization of the Research Report

Surgical residents' learning style preferences and the relationship with accessing education in a hybrid national scientific conference was studied. This chapter introduced the context of rapid adoption of virtual and hybrid meeting technology in the face of the COVID-19 pandemic, demonstrated the efficacy and use of hybrid learning, and provided a background on the concept of learning style preferences. Chapter 2 will offer a review of the relevant literature, chapter 3 will describe the study's research methodology and methods, chapter 4 will report the study's results and findings, and chapter 5 will discuss the study's results and findings and conclude by discussing implications for practice and offering recommendations for future research.

There is little research on the relationship between surgical resident learning style preference and engagement in educational activities, such as a hybrid scientific conference. This study will investigate that relationship and its implications for surgical education in the future.

Chapter Summary

Chapter 1 discussed the background and context of the study, including discussion of the impact of the COVID-19 pandemic, hybrid learning, and learning style preferences. Next, chapter 2 will delve into the literature in greater detail, exploring surgical training (and how it was affected during the COVID-19 pandemic), hybrid learning, and learning style preferences.

CHAPTER 2: LITERATURE REVIEW

Chapter Introduction

Surgical residents learn in a variety of environments as trainees. There is much literature in these traditional learning environments, including how learning style preferences might be applied. As these residents transition to practicing surgeons, they begin to learn in new settings, such as large conferences hosted by specialty societies where they can direct their learning more independently than while in training. These meetings offer various professional benefits, such as sharing current research and networking with colleagues. There is little information, however, exploring how this new generation of surgeons engages in educational content in such a setting, and what their preferences are for such learning.

In chapter 1, it was discussed that with the rapid adoption of virtual and hybrid meeting modalities necessitated by the COVID-19 pandemic, there is little information known about the relationship between surgical residents' learning style preferences and engaging with educational content in the context of a hybrid national scientific conference. This chapter will discuss a brief history of how surgeons are trained, the context of the COVID-19 pandemic and its impact on training and trainees, including on educational formats such as meetings and conferences, research into implementation of hybrid learning delivery, and an overview of learning style preferences and how they have been applied to surgical education. The theoretical framework for the study will be outlined as well.

How Surgeons Are Trained—A Historical Perspective

It may be helpful to first briefly describe how surgeons are trained. The current model dates back to 1889 and is attributed to William Stewart Halsted who implemented a structured, progressive, apprenticeship model where surgeons spent vast amounts of time learning from

other surgeons in a hospital setting, gaining more autonomy over time (Cameron, 1997; Halsted, 1904; Richardson et al., 2021). While much has changed since then, trainees still undergo lengthy and intense training to become a practicing surgeon. They have four-year undergraduate degrees, four years of medical school, and five years in residency training (American College of Surgeons, n.d.-c). Recent estimates cite 91% of current residents planning fellowship training beyond that (McClintock et al., 2019).

In order to become board-certified in surgery, certain requirements must be met during training. Among the many requirements, include a minimum of 850 operative procedures, with at least 200 of those occurring in the final (Chief) resident year (American Board of Surgery, 2022). It should be noted that these required case numbers were allowed to decrease by 10% in 2020 due to the impact of the pandemic described below (American Board of Surgery, 2020). Training is highly regulated to ensure quality and the board ensures that each surgeon it certifies meets these rigorous standards.

COVID-19 Pandemic and Its Impact

Impact on Surgical Training

The COVID-19 pandemic had a profound effect on how surgical training was conducted and it is critical to understand that shift in the overall context of what surgical residents were experiencing. The literature shows that the pandemic impacted the experience, progression, well-being, and educational format available for residents.

Experience

As COVID-19 emerged, resources were diverted to treating COVID-19 patients with non-elective procedures cancelled. Ellison et al. (2020, 2022a, 2022b), conducted a series of surveys with surgical education leaders involved in training residents during the pandemic with

the aim to fully capture the impact of the pandemic on surgical training. In Ellison et al. (2020), a mixed methods survey was distributed to surgical education leaders in general surgery and some specialties. They found that 87% of respondents reported severe reduction in surgical volume. There were severe reductions in most surgical training experiences surveyed. In Ellison et al. (2022a), two follow-up mixed methods surveys were distributed to surgical education leaders later in 2020 as a comparison to the initial survey in spring 2020. The lack of available PPE prevented non-essential personnel from entering operating rooms, also contributing to a lack of experience during this time (Ellison et al., 2022a). A one-year follow-up mixed methods survey was then administered to this same group (Ellison et al., 2022b). While the volume disruption decreased in the 2020–2021 academic year, it was not completely eradicated, with 14% of respondents still reporting severe disruption (Ellison et al., 2022b). In this survey, 41% of respondents reported total case numbers being reduced by more than 20% despite case volume overall increasing to normal levels (Ellison et al., 2022b).

This disruption was reflected in studies of residents directly as well. Abdelsattar et al. (2021) conducted six focus groups of surgical residents to understand their lived experiences and inform future disaster planning. Residents expressed concerns about having a decreased volume of cases and shortage of experience. One resident said they "'…will never be able to make up those cases…'" as the time lost operating results is less experience and less preparation (Abdelsattar et al., 2021, p. 1854). Educational opportunities suffered as practicing surgeons, rather than residents, performed more cases to increase efficiency. In an anonymous survey by Coleman et al. (2021) of residents and fellows, 84% reported a greater than 50% decrease in operative volume and anticipated not being able to meet their case requirements. Aziz et al. (2021) conducted a quantitative survey of residents with 1,102 responses to investigate the effect

of the pandemic on surgical trainees, including burnout. They found that 42% of residents reported not being able to meet case numbers (Aziz et al., 2021). Abdelsattar et al. (2021) did observe however, that some residents were less concerned about volume and that it "would work itself out" (p. 1855). The cancellation of procedures due to COVID-19, led to case volume decreases for residents and seriously impacted their training and experience.

Progression

Due to this lack of experience, progression in training was cited as a concern (Ellison et al., 2020). Changing the rotation schedule was most common to address issues in case volume to provide the necessary experience. There was concern however that "prolonged decreases in case numbers of this magnitude may make it difficult for [program directors] PDs to accurately assess a trainee's readiness for promotion or independent surgical practice" (Ellison et al., 2022b, p. 206). Coleman et al. (2021) asked residents about professional autonomy and 59% reported either a great or moderate impact on their ability to proceed in operative autonomy. Advancing to the next year in training was also impacted, as reported by approximately 20% of programs, where adjustments in the curriculum were needed to keep residents on track (Ellison et al., 2022a). While actually delaying progression was rare (Ellison et al., 2020; Zheng et al., 2020), remediation was expected to be necessary for 53% of junior residents (Ellison et al., 2020). Overall, progression to the next years of training was a concern for both residents and educators, yet curricular adjustments were made to avoid serious setbacks.

Well-being

Impact on trainee well-being was more severe in programs that were more acutely impacted by the pandemic in terms of case numbers and did not improve over the later months in 2020 (Ellison et al., 2022a). They found that educators saw "isolation (noted by a large number

of participants), anxiety, general fear of COVID, missing family and for their safety, resentment for a poorly perceived institutional response, and concerns about PPE [personal protective equipment]" (Ellison et al., 2022a, p. 398). In 2020 and 2021, 70 to 75% of respondents, residents, fellows, and surgical educators reported negative effects on their mental health or feelings of burnout (Coleman et al., 2021; Ellison et al., 2022b). Among the top concerns for residents and educators was spreading COVID-19 to others (Aziz et al., 2021; Coleman et al., 2021; Ellison et al., 2022b). Learners also experienced fatigue around the availability, changing rules regarding PPE, and the additional protocols around continually taking it on and off (Abdelsattar et al., 2021; Ellison et al., 2022b). Overall, resident well-being was negatively impacted during the pandemic.

Educational Format

The COVID-19 pandemic also necessitated a rapid shift in the traditional approaches to surgical education for residents. Technologies were quickly adapted to meet educational needs and keep training proceeding as much as possible. Severe disruption in education continued for almost 30% of programs throughout 2020 and educational programs seemed to lag in the recovery (Ellison et al., 2022a). Virtual conferences were adopted by 97% of respondents regardless of the prevalence of COVID-19 in that geographic area (Ellison et al., 2020). Simulation labs were largely unavailable to practice skills independently (Ellison et al., 2020).

Some of these changes, however, were cited as successes in the surgical education literature and included a switch from in-person to virtual education and videoconferencing (Abdelsattar et al., 2021). Researchers found that residents reported improvement in the quality of didactic learning with an increased diversity of speakers afforded by a virtual platform delivery. The ease of connection and flexibility increased attendance and were additional

benefits. Some did mention that engagement suffered in a virtual format (Cassidy et al., 2023). Ellison et al. (2022b) also found that one year out, the vast majority of educational activities were still being offered virtually.

Overall, the COVID-19 pandemic had a severe impact on surgical training. Operative volume decreased, which negatively impacted surgical education as there was a lack of available experiences (Ellison et al., 2020). While overall progression was not as severely impacted, program directors changed rotation schedules to accommodate for the change in volume, which was seen negatively by residents (Ellison et al., 2020; 2022b; Coleman et al., 2021). Surgical resident well-being was also negatively impacted as fear with infecting others was common as well as anxiety related to the procurement of PPE (Ellison et al., 2022a). Most programs offered education via virtual methods to maintain social distancing, which had the advantage of increasing accessibility and attendance, yet some reported decreased engagement (Ellison et al., 2020).

Impact on Surgical Meetings and Conferences

Resident education was severely impacted by the pandemic due to changes in the available experiences and education provided. The utilization of distance education and hybrid learning technologies during the pandemic may be one lasting change in delivering educational content (Cassidy et al., 2023; Terhune et al., 2020). This extended to larger surgical meetings and conferences as well. While many conferences deliver information primarily via a lecture format, this was translated to online delivery. Surgical conferences offer a variety of benefits for attendees. They provide the opportunity to not only learn about new research in the field, but also to hear about new approaches to current issues and network with colleagues (Vervoort et al., 2021). This educational venue offers important professional development for attendees.

Terhune et al. (2020) shared a case study on the rapid shift to virtual delivery that happened in a surgical education conference in the beginning of the pandemic. Planning that would have normally taken one year for an in-person conference was condensed into one month. That conference utilized three forms of distance delivery: prerecorded presentations; online conferences; and live streaming. There were 298 registrants and when surveyed, levels of satisfaction were consistent with previous in-person conferences when evaluated on the basis of content, relevancy, and format. The attendees cited the greatest considerations for them being the cost and value, their location, and the volatile trajectory of the pandemic. The success was such that virtual components were requested for future meetings. Lessons learned from this experience included replicating important aspects of in-person meeting interaction such as the content and networking and reproducing those features online. Having the ability to revisit content after the fact, was cited as a key benefit as well.

Vervoort et al. (2021) depicted a similar experience in their case study when that annual meeting was shifted to a virtual delivery modality. Six thousand attendees participated in a virtual conference of cardiothoracic surgeons, which made it one of the largest meetings of that society. This also marked significant global involvement, rather than being limited to domestic attendees. Relatedly, as reported by Abdelsattar et al. (2021) where the barrier to delivering a diverse group of speakers was lowered, here the barrier to attendance was lowered.

Hameed et al. (2021) sent an online survey to urology healthcare providers to ascertain their preferences for hybrid meetings when national urology conferences were converted to virtual meetings during the pandemic. Of the 526 respondents, 98% were practicing urologists or trainees. Respondents rated hybrid and virtual webinars superior to face-to-face meetings in several domains including the opportunities for learning, scientific value, most current

information, and speaker quality. The aspects of networking and collaboration continue to be preferred in face-to-face settings. It is of interest when this conference was converted to virtual, it was reported as being successful and delivering all the same important scientific content as the traditional conference format (Kaizer, 2020).

The COVID-19 pandemic had a profound impact on surgical training; decreased resident experience, increased risks to progression, decreased well-being, and shifts to virtual education delivery. Scientific surgical meetings were nearly universally shifted to a virtual or hybrid delivery but were well-received overall and likely to continue in some manner in the future. Hybrid learning more broadly will be discussed next.

Hybrid Learning

There have been alternatives to in-person instruction for many years. As hybrid meeting technology for conferences was widely adopted rather recently, research in the area is still developing. Hybrid learning as applied to more traditional learning environments has been studied more extensively and will be primarily discussed below. Additionally, in the early days of the pandemic when social distancing was in place, completely virtual options were employed, which did not have an in-person component. The terms hybrid and blended learning are often used interchangeably. However, consensus is that it combines some aspect of in-person and online learning (Hrastinski, 2019). As this was the impetus for much of the hybrid delivery offered thereafter, examples of both hybrid and completely virtual education are addressed.

Effectiveness

It is important to evaluate hybrid learning in relation to traditional teaching methods. Bird et al. (2020) reviewed more than 350,000 evaluations from learners between 2015 and 2017. All of the activities were provided by the American Academy of Family Physicians. These

evaluations were given at the conclusion of educational activities and asked learners about the activity and the authors compared the nine different educational formats of those activities with the self-reported effectiveness and the learners' expected change in behavior. The types of activities included various kinds of traditional live and online activities, such as lectures, case studies, and skills training. The delivery format that learners most rated as having an impact on how they practiced was the hybrid delivery format. Interestingly, both the live and online skills training ranked higher than a traditional and commonly used live lecture, suggesting that a conventional method for delivering information may not be the most effective.

Schaber et al. (2010) conducted a mixed methods study using a survey and focus group of graduate learners when a course was shifted from a traditional classroom environment to a blended format. Ninety-eight students were surveyed over a three-year period. Further, researchers were able to compare four elements that were present in both course formats. Three of those four elements in the blended version were rated as having a greater contribution to learning with the remaining one being equal in both formats. The gains in learning were larger over seven different topic areas in the blended format than the traditional classroom version. When comparing classroom and blended formats, students in the blended format had a perception of better content understanding than those in the traditional classroom approach. This finding was consistent with Bock et al. (2018) when in-person lectures were transitioned to a blended learning format, this time for oral and maxillofacial surgery learners and this focused on surgical techniques. Comparisons of both the traditional and blended learning approaches were compared, and students rated the blended format highly and the online content was the preferred resource.

While social connection may be one limitation of virtual learning, Coe et al. (2020) recommended virtual education as a way to maintain educational delivery and camaraderie among residents when in-person learning is unavailable. Going forward, this can be useful for rotations when residents may be away from their primary institution. This was similarly reported by Abdelsattar et al. (2021) when implementation of virtual education was seen favorably.

Despite the rapid widespread adoption of distance/hybrid technology for education in a new environment, such as surgical education, and as necessitated by the pandemic, there is empirical evidence of its efficacy, or even superiority, to traditional classroom instruction. Some learners prefer hybrid methods of delivery compared to face-to-face options.

Skills Training

In surgical education, it is important to evaluate the efficacy of a virtual or blended format when delivering education related to a technical skill. As rural general surgeons may have limited access to traditional methods of learning, Halverson et al. (2014) implemented a blended course geared toward this population. This survey study used an end-of-course evaluation to measure effectiveness of the format. Eighty-nine percent of respondents indicated that the knowledge acquired would improve their practice and quality of care they could provide. They cited that their skills had been refined, and they could offer additional care options to patients. Further, they indicated planned changes based on what was learned in the course.

McGann et al. (2021) implemented a virtual skills course for medical students. This course covered basic skills such as suturing and knot tying. Learners practiced independently and received feedback from both peers and faculty. Almost all students met the course objectives and increased confidence in the skills the course addressed. Students reported that while the faculty

feedback was more important than that from peers, the online delivery was equivalent to in person.

Lindeman et al. (2015) implemented a blended curriculum for 237 medical students interested in surgery. This included lectures and clinical experiences. When compared to traditional methods, there was no differences in standardized exam performance or faculty evaluation of their performance. In fact, teachers in the blended curriculum received higher ratings from students.

Acaroglu et al. (2022) conducted a mixed methods study evaluating a blended course using pre- and posttests as well as login information and surveys. They implemented three courses on spine surgery in a blended format and found that learners reported high satisfaction with the delivery and objectively improved their knowledge in the area. Two of the three courses offered showed statistically significant decrease in the gaps in knowledge.

There is evidence that blended learning is an effective method for delivering skills training. Not only is it successful as an educational delivery modality (Halverson et al., 2014; Lindeman et al., 2015), but also learners can find it equivalent (McGann et al., 2021) or more effective than traditional methods of content delivery, like a face-to-face lecture (Bird et al., 2020; Schaber et al., 2010).

Influences of Modality Choice

While hybrid or virtual learning may be as effective as traditional methods, many factors influence how a learner may want to study a concept. O'Brien Pott et al. (2021) sought to review influences of choosing one modality over another. The researchers surveyed 500 clinicians, including physicians, nurses, and physician assistants. The survey asked about different

modalities for choosing continuing medical education (CME) opportunities and characteristics of the providers.

The most important factors cited in choosing a particular activity included the topic, the quality of content, availability of CME credit, and clinical practice focus (O'Brien Pott et al., 2021). Most respondents anticipated using live education, followed by online. The aspect of online education that was the most highly rated was that it could be done as time permitted. The aspect of live education that was the most highly rated was that it was a topic that was best taught live. Carpenter et al. (2022) had a similar finding when they conducted a mixed methods study with general surgery residents. While in-person learning was preferred, the virtual delivery content was still rated highly, with virtual delivery preferred by nearly 95% to none at all. Those researchers posited a hybrid delivery model may be of most benefit in the future.

As Ellison et al. (2022b) reported above in their 1-year follow-up survey, ease of delivery, social distancing, and increased attendance were all benefits to the virtual delivery of surgical education. A common limitation is the lack of engagement by participants. Due to limitations, nearly 70% expected transitioning to hybrid and in-person conferences when it was safe to do so (Ellison et al., 2022b). Despite the efficacy and flexibility of hybrid learning, there are still some preferences for learning in person, especially based on the subject to be learned.

Hybrid educational delivery can be implemented in a variety of ways. Not only is it used in traditional educational settings, but also in larger scientific conferences. With the rapid reliance on virtual and hybrid modes of delivery for education necessitated by the pandemic, it is important to understand the efficacy and benefits of these methods compared to traditional classroom-based education. These methods were effectively implemented during the pandemic across surgical fields despite the lack of time for planning. Learners consistently rated the

experience with great satisfaction compared to traditional classroom learning. Being able to review content as needed is frequently mentioned as one of the benefits of hybrid learning, especially when content is available for review at times and frequency determined by the learner. This self-directed nature of learning might be categorized into particular learning styles. Next, the chapter will address the literature related to how people learn using the framework of learning style preferences.

Learning Style Preferences

Literature indicates that in order to effectively train surgeons, an understanding of how they learn is crucial (Richard et al., 2014; Sachdeva et al., 2021). Researchers have also found a statistically significant difference in learning style between medical students and both residents and faculty, which they concluded could impact future education (Engels & de Gara, 2010). The underlying frameworks for learning styles are discussed, followed by its application in surgical fields and concluding with critiques to the theory.

Theories in Adult Learning

Adults integrate new information in many different ways. This has been investigated over time with more recent leading theories established by Malcolm Knowles, David Kolb, and Neil Fleming.

Knowles Andragogy

Malcolm Knowles (1970) was a pioneer in the 1970's building upon previous research into adult learning with a more unified framework of andragogy. When this was first introduced, it was groundbreaking. This model of andragogy identifies core principles of adult learning, which may differ based on the individual learner, the specific situation, or even the subject matter. Core to adult learning, adults as compared to children, have gained real life experience

and as such, need to know why something is important to know, have self-determination on learning it, be willing to acquire information, and are more intrinsically motivated (Knowles et al., 2014).

Kolb Experiential Learning Theory

Again, building on prior adult learning foundations, Kolb's (1984) ELT posited that a learner's experience impacts their learning, and this is not only limited to life experience, but also the reflection, analysis, and experimentation that accompanies it. There are six main aspects to this theory:

1. Learning should be thought of as a process, rather than an end result.
2. Learning should take into account a learner's current ideas and integrate more sophisticated information.
3. Conflicts in assimilating information are what drives learning.
4. Learning is not just cognition. All aspects of a person are part of learning, including emotions.
5. Learning occurs when information is exchanged with the environment.
6. Learning results in knowledge creation, rather than transmission.

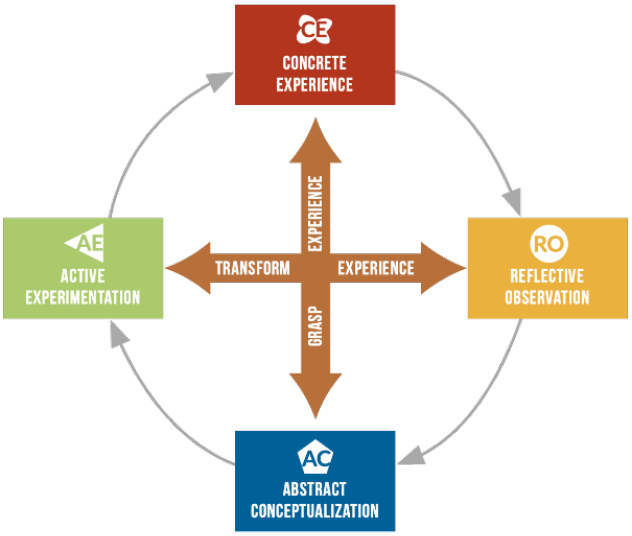
This is an active process on the part of the learner, rather than information merely being passed from an expert to the learner. It is also a cycle where experience is integrated and reflected upon and then integrated into the learner's understanding where new learning can be built.

Derived from ELT was the Kolb LSI, which aims to categorize learners based on their preferences in assimilating and processing experiences. As described by Kolb and Kolb (2005a), "the ELT model portrays two dialectically related modes of grasping experience—Concrete Experience (CE) and Abstract Conceptualization (AC)—and two dialectically related modes of

transforming experience—Reflective Observation (RO) and Active Experimentation (AE)" (p. 194). See Figure 1, The Experiential Learning Cycle. This description hearkens back to the concept of learning resulting from continual conflict assimilating information. The combination of these tendencies, and the preferences toward using certain ones more frequently, can be defined as a learning style. The answers to the Kolb LSI would categorize a learner into one of four learning styles, Accommodating (CE/AE), Converging (AC/AE), Diverging (CE/RO) or Assimilating (AC/RO). Figure 1 shows how these styles relate on the axes of perceiving and processing experience.

Figure 1

The Experiential Learning Cycle



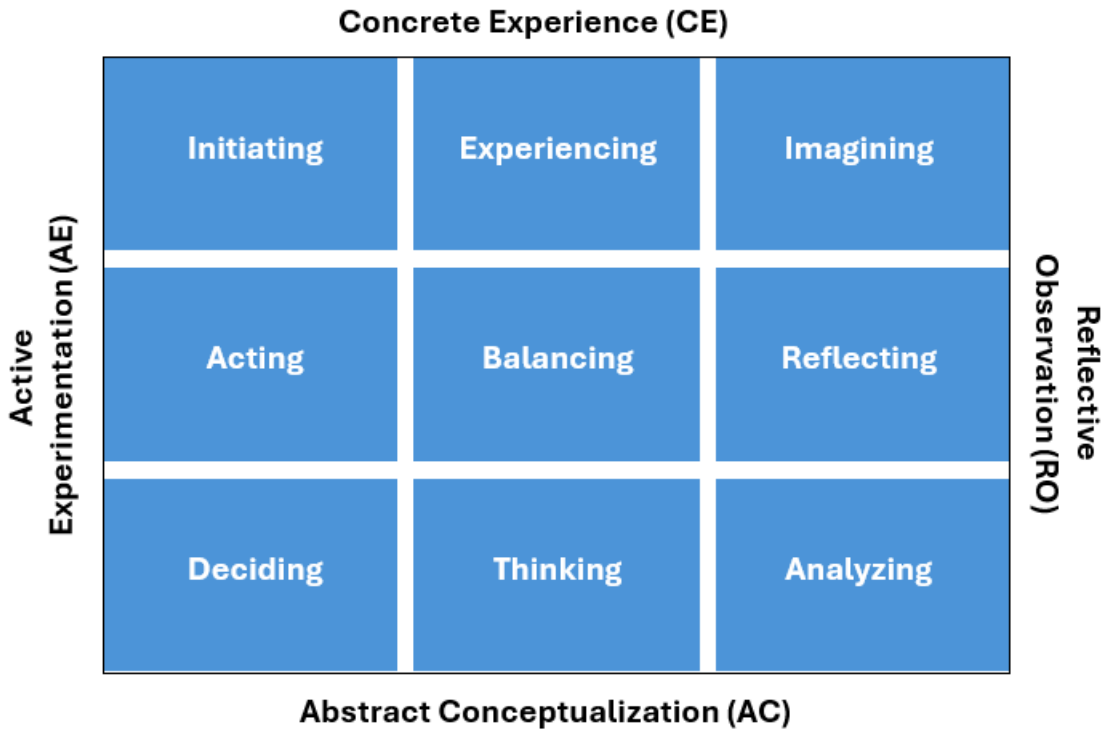
(Kolb & Kolb, 2021. Reprinted with permission.)

Kayes (2005) independently reviewed the Kolb LSI version 3 in a study with 221 students. Based on the sample who took the inventory, Kayes found it showed internal reliability and validity, which was consistent with prior research findings. To accompany the Kolb LSI, summaries have been released of reliability and validity studies conducted, which show internal reliability among different groups (Kolb & Kolb, 2005a, 2013).

It should be noted that while the LSI was first released in 1971, it has been substantively updated several times in 1985, 1999, and 2011 (Kolb & Kolb, 2013). Version 4.0, released in 2011 refined the previous model and introduced nine learning styles based on the results of the inventory, which are categorized based on where the learner places emphasis in the learning cycle and helped to clarify ambiguity when learners may be between two styles (Kolb & Kolb, 2021). The most recent version released in 2021, called the Kolb Experiential Learning Profile ([KELP], Institute for Experiential Learning, n.d.) maintains the nine-style model. The nine styles are Initiating, Experiencing, Imagining, Reflecting, Analyzing, Thinking, Deciding, Acting, and Balancing, Figure 2. The KELP reliability and validity are based primarily on that of previous versions and additional study in this area is needed (Kolb & Kolb, 2021).

Figure 2

Nine Styles in KELP



(Kolb & Kolb, 2021. Adapted with permission.)

Fleming VARK

In 1995, Fleming introduced a model of learning style based more on how information is received, rather than on how it is processed. The VARK model and inventory categorizes learners based on a preference for visual, aural, read/write, or kinesthetic information presentation. In this way, a student might be able to focus on gathering information in a way most suited to their learning style.

In summary, several theoretical approaches exist to explain how adults learn. Prominent theories from Kolb and Fleming also have accompanying inventories that attempt to describe learners based on their preferences. Both models have been used to investigate the population of surgical learners.

Learning Styles as Applied to Surgical Fields

Previous research has primarily investigated the dominance of a particular learning style or the relationship between surgical residents' learning styles and objective outcomes such as standardized exam performance (Kim et al., 2015, 2018). These studies have used both the VARK and Kolb LSI and will be discussed below.

Studies using the VARK Inventory

Kim et al. (2015) compared the responses to the VARK inventory of 53 surgery residents over a two-year period to standardized exam performance and found the majority (51%) had a multimodal style, while those who had a read/write style had higher exam scores. In a later study, Kim et al. (2018) conducted a multi-institutional study again using the VARK inventory and the same standardized exam and found that those who had an aural style had higher exam scores and that overall, the 132 participants had a statistically different distribution of VARK styles when compared to the population in general. While the results are somewhat inconsistent

with one another, the authors surmised that utilizing this model could increase the efficiency of learning.

Studies Using the Kolb Learning Style Inventory

Many studies have investigated surgeons or trainees in various specialties using the Kolb LSI to identify dominant learning styles with the goal to gain insights into learners in this population. While some common themes emerge, there are notable differences.

Engels and de Gara (2010) investigated general surgeons and administered the Kolb LSI to three different groups at a single institution: medical students, general surgery residents, and general surgery faculty. The dominant styles were Converging and Accommodating. While there was no significant difference in learning style between the residents and faculty, they found a significant difference between those groups and medical students by comparison. The medical students more frequently had an Assimilating style as compared to residents and faculty.

Richard et al. (2014) used the Kolb LSI to review the learning styles of 71 orthopaedic residency applicants, residents, and faculty members. They too found a majority, 53.5%, had a Converging style. By contrast, however, in this study none of the younger participants had an Assimilating learning style as compared to those in the older age groups. Both researchers, however, concluded that teaching could be tailored to groups based on learning style which may increase efficiency of learning.

Quillin et al. (2013) theorized that learning styles focusing on active experimentation would be dominant among surgery residents given their preference for learning through action, similar to Engels and de Gara (2010). They found that the areas of Converging and Accommodating learning styles were dominant among those who ended residency with a high number of cases, whereas those who learned more by observation, were more likely to transfer

out of the surgical specialty or out of medicine altogether. They too proposed that this knowledge of learning style could increase learning efficiency.

Lai et al. (2014) evaluated 81 neurosurgeons, neurosurgery residents, and neurology residents across three sites. Somewhat differently, they found a preference for Assimilating and Diverging styles, with more seasoned neurosurgeons favoring an Assimilating style, similar to the findings of Richard et al. (2014).

When Laeeq et al. (2009) provided the Kolb LSI to 43 otolaryngology (head and neck surgery) residents in two training programs, they found that nearly 75% had a Converging or Accommodating style, consistent with the later findings of Engels and de Gara (2010), Quillin et al. (2013) and Richard et al. (2014). Yet when Varela et al. (2011) administered the Kolb LSI to otolaryngology fellows across 25 programs, they found that the vast majority, 60%, had a balanced style, which is even across all four styles. They surmised that being further along in training accounted for this difference.

Saldanha et al. (2019) administered the Kolb LSI to 45 plastic surgery residents across three programs and found a varied combination of styles, rather than one dominant style. They did however find a dominance for styles that favor more active learning. In contrast to some other studies, there was a more even distribution of learning styles among this sample of residents.

In summary, Accommodating and Converging styles appear to be common in surgical residents and those in surgical fields. This is consistent with Quillin et al. (2013) who found a relationship toward learning styles preferring action to the success of residents in surgery. Richard et al. (2014) and Lai et al. (2014) both found that the Assimilating learning style became more prevalent with age. Even with somewhat incongruous data, researchers continue to believe

that learning style can have a positive impact on learning effectiveness and efficiency. At the time of this writing, independent studies in surgical fields utilizing the newest version of the Kolb inventory, the KELP, were not available. Kolb and Kolb (2021) do note how it has been previously validated in medical fields with those in medical fields trending toward learning styles oriented toward more active experimentation.

Critiques of Learning Styles

While there has been much research devoted to investigating learning styles, irrefutable evidence of their validity is still lacking (Cuevas & Dawson, 2018). There are also those who argue that the evidence does not support the theory of learning styles and they may be "situational, at best" (Sachdeva et al., 2021, p. 15). Some also say that only teaching to a particular style could be harmful to learning (Nancekivell et al., 2020). It should be noted that many of these critiques are leveraged toward the VARK model where content is delivered only in a particular way that aligns with their VARK style. The predominant theory in this study, the Kolb Experiential Learning Theory, acknowledges changing dynamics and recognizes that learners move through the learning cycle and have different needs or preferences at different times. It further notes that preferences are "not a fixed psychological trait, but a dynamic state resulting from the synergistic transactions between the person and the environment" (Kolb & Kolb, 2021, p. 8) and thus can change.

While a variety of factors undoubtedly impact how well a learner acquires knowledge in a given situation, one could argue that any insight into how learners absorb knowledge would be helpful in better designing educational interventions to improve learning. As noted, above several researchers suggest the benefits that could be realized by better tailoring learning to the learner (Engels & de Gara, 2010; Quillin et al., 2013; Richard et al., 2014). Developing

applications in education with the addition of artificial intelligence suggest that personalized learning will become more common (Fadel et al., 2024) and learning style preferences may be one lens through which to view such individualized approaches.

As evidenced above, some findings are contradictory, and it is difficult to discern if certain learning styles of individuals pursuing careers in surgery are indeed more common. Researchers, however, continue to surmise that some understanding of learning can help improve efficacy and efficiency of learning (Lareeq et al., 2009, Saldanha et al., 2019). Learning styles have been evaluated in many contexts with varying results. There is no consensus on the reliability of learning styles despite their widespread use. However, the framework continues to be helpful when analyzing education in surgical fields. Despite investigation into learning styles, there is little research on the relationship between resident learning style preference and engagement in educational activities like a hybrid scientific conference.

Theoretical Framework

This research study is approached from a constructivist worldview. According to Creswell and Creswell (2018), “social constructivists believe that individuals seek understanding of the world in which they live and work” (p. 8). Meaning can also be derived from experiences. This approach lends itself to an action research approach, which is defined by McCutcheon and Jung (1990) as

> systematic inquiry that is collective, collaborative, self-reflective, critical, and undertaken by the participants of the inquiry. The goals of such research are the understanding of practice and the articulation of a rationale or philosophy of practice in order to improve practice. (p. 148)

This also aligns with the Kolb ELT, in which learning is primarily gained and assimilated through experience.

Chapter Summary

While there is research into surgical resident learning styles in general, there is little research on the relationship between surgical resident learning style and preferences in engagement in educational content, such as a hybrid scientific conference. This study investigated that relationship and its implications for surgical education in the future. The study was guided by the following research question: What is the relationship between surgical residents' learning styles and their preferences engaging with professional development content in the context of a hybrid national scientific conference?

This chapter presented a summary on the training surgeons undergo to become practicing surgeons. The impact of the COVID-19 pandemic on surgical education and trainee experience was also discussed. Hybrid learning approaches were explored with specific successful examples of the virtual conferences held during the pandemic. The chapter also provided a background on learning styles, their applications in surgical education, and challenges to the approach.

In this study, surgical resident attendees at a national scientific conference took a validated learning styles inventory and confidential survey on professional development content delivery preferences. This information was then compared to conference attendance and educational program access information. This action research project studied surgical residents' learning style preferences and the relationship with engaging in continuous professional development in a hybrid national scientific conference. Next, chapter 3 will describe in detail the research methodology and methods used in this study.

CHAPTER 3: RESEARCH METHODOLOGY AND METHODS

Chapter Introduction

With the rapid adoption of virtual and hybrid meeting modalities necessitated by the COVID-19 pandemic, there is little information known about the relationship between surgical residents' learning style preferences and their engagement with educational content in the context of a hybrid national scientific conference. The purpose of this study was to uncover surgical residents' learning styles and illuminate their preferences engaging in professional development in the context of a hybrid national scientific conference. The study was guided by the following research question: What is the relationship between surgical residents' learning style preferences and their engagement with educational content in the context of a hybrid national scientific conference? This chapter will address the research methodology and research context, including the setting and description of participants. Research methods will be discussed with topics such as the procedures used and the timeline. Methods of data analysis and research ethics will also be explored.

Research Methodology

Mixed Methods Approach

To explore the relationship between learning style and engagement in hybrid education, this action research study used a convergent mixed methods design. According to Creswell and Creswell (2018), a convergent mixed methods design "merges quantitative and qualitative data in order to provide a comprehensive analysis of the research problem" (p. 15). Quantitative data was collected in terms of the learning style profile used, closed-ended survey questions, and attendance data. Open-ended survey questions were also used to collect respondent opinions. As noted in Creswell and Creswell (2018), the advantage of utilizing both quantitative and

qualitative methods is thought to offset the disadvantages inherent in each method. This approach, however, is more recent than traditional quantitative or qualitative methods used alone.

The mixed methods approach allows researchers to gather both concrete and nuanced information on a topic. Several studies that gathered information around the time of the pandemic also utilized this approach to gather both types of data (Ellison et al., 2020; Ellison et al., 2022a; Huntley et al., 2020). These studies used both open- and closed-ended survey questions to address their research topics. The survey in this study also used open- and closed-ended questions to collect both quantitative data for comparison and description of the sample, but also through qualitative data allowed respondents to elaborate on their opinions and highlight important aspects that might not have been addressed.

Action Research

This study also used an action research approach. A benefit of action research is for educators to apply their learnings to the educational environment (Mertler, 2020). As noted in Mertler (2020), action research is a "critical analysis of educational places of work" (p. 18). This action research study utilized the practical action research approach. Practical action research is defined by Mertler (2020) as "addressing a specific problem or need in a classroom, school, or similar community" (p. 19). This study is considered practical action research as it aims to improve the education which the researcher is involved. This approach has been used elsewhere in the surgical education literature. Engels and de Gara (2010) used an action research approach to improve education at their institution. They investigated the learning styles of medical students, surgery residents, and surgical faculty using the Kolb LSI to identify relationships between those learners.

Nes et al. (2022) used action research to collaboratively work with surgeons to develop a new communication curriculum. Using action research to understand the perspective of the learner is especially effective for education. The authors critically analyzed education for impact, a purpose shared with this current study.

Okita et al. (2023) used a collaborative action research approach to develop a rubric for assessing surgical trainees based on a need the researchers perceived. Educators worked together to implement the rubric, reflected on what could be improved, and made plans to put those plans into action. Action research can be a useful approach to examining a particular educational phenomenon, however, it is not cited as an approach as frequently as more traditional scientific methods in the surgical education literature.

Research Design

This study used a variety of data points to evaluate educational content and the learners' engagement. As will be discussed, a validated LSI was completed, followed by attendance at a hybrid scientific meeting. Attendance data were collected, and a follow-up survey was completed. These various insights aimed to shed light into answering the research question investigating the relationship between surgical resident learning style preference and engagement in educational content at a hybrid scientific meeting.

Similarly, Acaroglu et al. (2022) evaluated the effectiveness of a blended course using surveys, quizzes, and login information of participants. While this approach can provide unique insight, its specificity may make results less generalizable. Dickinson et al. (2021) used an LSI and compared those results to subsequent survey results on teaching effectiveness. In Kim et al. (2015, 2018), researchers used an LSI and compared those results to performance on a

standardized exam. Together, these examples show how data about learning style, education program attendance, and a respondent survey can be combined to shed light on a phenomenon.

Research Context

Research Setting

As this study aimed to investigate surgical resident engagement at a hybrid national scientific meeting, a large, hybrid, national scientific conference was the research setting. The conference is held annually in large cities across the United States. The conference was held in Fall 2023 at a convention center in the northeastern United States. Content presented in person was made available online within hours of presentation, with several sessions live streamed as well. All in-person attendees had access to online content. The learning style profile was completed online and asked to be completed prior to the conference at a time convenient for the participant, and the follow-up survey was distributed via email three weeks following the conference.

Participant Recruitment and Selection

Participants were current surgical residents registered for the conference. Recruitment emails were sent four weeks to 10 days prior to the conference to registered residents inviting them to participate. Inclusion criteria were based on registration data, and status as a resident in the United States, which was based on membership data. The goal was to have 65 participants in the study. Recruitment emails were to cease once 65 participants had been identified. If more than 65 participants expressed interest, then a group was to be randomly selected from those who expressed interest.

Participants received a personalized learning profile, which may have been a perceived benefit. All participants received a profile, and if more than the desired sample size expressed interest, then the group was to be randomly selected so the potential benefit was equitable.

A list of residents registered for the conference was pulled from the registration database and recruitment emails were sent from the researcher's university email address inviting them to participate. New registration data were pulled three weeks later to include newly registered residents. Prospective participants received one initial email and one reminder one to two weeks apart.

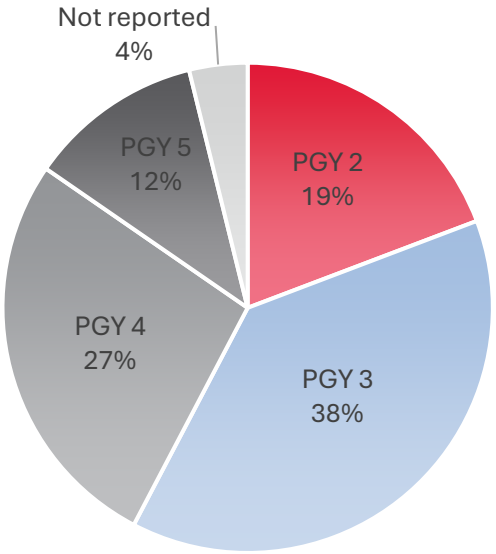
Participants

Letters of invitation, included in Appendix A, were sent to the population of 1,232 surgery residents who were registered for the conference. A nonprobability sample of 70 expressed interest in participating in the study. Creswell and Creswell (2018) defines a nonprobability, or convenience, sample as "respondents are chosen based on their convenience or availability" (p. 150). Sixty completed the informed consent, included in Appendix B, 35 fully completed the Kolb Experiential Learning Profile (KELP) and there was one partial completion which was not counted as there was no learning style determined, for a response rate of 2.8%. Twenty-six participants completed the follow-up survey, included as Appendix C, thereby completing all parts of the study. Twenty-two included identifying information to tie their survey responses to their KELP learning style. Results include summaries of the KELP reports (n = 35) and responses to the mixed methods survey (n = 26), for those who participated in each. Triangulation between the KELP outcomes and survey results is limited to the 22 participants who included identifying information to connect their KELP assessment and survey results.

Participants were 73% Women (n = 19), 27% Men (n = 7). Median age was 30 years, and the distribution of postgraduate year (PGY), depicted in Figure 3, was 19% PGY 2 (n = 5), 38% PGY 3 (n = 10), 27% PGY 4 (n = 7), 12% PGY 5 (n = 3). One participant (3.8%) did not provide their PGY level.

Figure 3

Distribution of Surgical Resident Postgraduate Year (PGY)



Participants' residency program type varied, with 88.5% coming from university programs (n = 23), 7.7% coming from independent programs (n = 2), and 3.8% (n = 1) from military programs. Program size varied and was reported by 18 participants, then collapsed and categorized by the researcher into groups as small programs (less than 10 residents; n = 1), medium sized programs (11–49 residents; n = 6), and large programs with 50 or more residents (n = 11).

Researcher Positionality

Researcher positionality can have an impact on the study and in qualitative research, it can also impact interpretation of the data (Creswell & Creswell, 2018). It is important to address

aspects and potential biases as a researcher that could have an impact on the interpretation of results.

During the researcher's tenure working in medical associations, their portfolio of programs has included surgical residents, their transition into independent practice, and projects related to the evaluation and improvement of surgical training. The author has also attended numerous medical association annual meetings providing staff support.

As a staff member of the organization that hosts the conference where the study occurred, the researcher would be considered an insider. Herr & Anderson (2015) describe this type of action research as "being done *by* or *with* insiders to an organization or community" (p. 3). While the dual role of staff member and researcher was made known to study participants and steps were taken to maintain separation between staff and researcher responsibilities, such a role could have affected interest in participation or participant responses.

As a staff member with 10 years of tenure attending the conference under investigation, the researcher could be seen as invested in its continued success. The researcher is a White, middle-class female from the Midwestern United States. Coming from a place of privilege may introduce biases into interpreting comments from participants. Previous work experience has predominantly been in fields within education and those experiences could have an impact on the interpretation of results.

Research Methods

Data Collection

The relationship between learning style preference and engagement in hybrid education was collected in several ways. This section will discuss the instruments used, and the procedures and timeline followed.

Instruments

The first instrument used identified participants' learning style and was the KELP. This online inventory is based on Kolb's (1984) ELT where "experience is translated into concepts, which in turn are used as guides in the choice of new experiences" (p. 21). According to the Institute for Experiential Learning (n.d.), "the new KELP gives a broader and more personalized view of how we learn than previous learning style instruments" (para. 5). It consists of multiple forced-choice questions that ask learners about how they prefer to learn. The KELP was the most recent version available through the Institute for Experiential Learning, which is the organization that supplies the Kolb assessments. In previous versions of the inventory, reliability and validity studies were conducted as well as normative data based on over 26,000 users (Kolb & Kolb, 2021).

The 26-question follow-up survey was developed by the researcher and used open- and closed-ended questions which asked participants their opinions on the educational content at the conference and delivery of the content. Mertler (2020) indicates a survey "involve[s] the administration of a set of questions or statements to a sample of people" (p. 144). The survey used both open-ended questions "where individuals provide their own responses" (Mertler, 2020, p. 144) and closed-response rating scales, "where individuals select their response from a set of options provided to them" (Mertler, 2020, p. 144) that asked about their motivations, preferences, and considerations for engaging in hybrid education. It also addressed the participants' intentions to engage in content in different ways and their opinions of their learning style generated by the KELP. Demographic information collected included: type of residency program, program size, PGY, gender, and age. These demographics were linked to the data and

used to describe the sample. The survey was developed prior to engaging any participants in the study.

Procedures and Timeline

Two weeks before the conference, those who expressed interest received the informed consent form, included as Appendix B. Once they agreed, they could immediately access a link to submit their name and email address which would generate a unique invitation to complete the LSI, the KELP. Upon completion of the inventory, they automatically received via email their personalized learning style report from the Institute for Experiential Learning indicating their dominant learning style and specific learning insights based on that style.

Participants then attended the 5-day conference and could engage in educational content either online, in person, or both. Three weeks following the conference, an email was sent to all participants asking them to complete a secure online follow-up survey using REDCap software. The REDCap software "is a secure web application for building and managing online surveys and databases" (Project REDCap, n.d.). The delay between the conference and the follow-up survey allowed time for participants to view meeting content online if they chose to do so. One reminder was sent 3 weeks after the initial invitation based on those who had not yet completed the survey.

Lastly, in-person attendance data were available to the researcher four weeks following the meeting and online viewing information was available four months following the meeting, indicating participants' actual participation in education during the conference. According to Mertler (2020), using these existing documents and records "are essentially anything collected for a reason *other* than the action research study but are now being used as data for the study" (p. 139). This allowed the researcher to triangulate actual behavior with learning styles and

participant opinions. Mertler (2020) defines triangulation as “a process of relating multiple sources of data in order to establish their trustworthiness or verification of the consistency of the facts while trying to account for their inherent biases” (p. 13). Using multiple data sources in this manner can provide a robust picture of a phenomenon.

Data Analysis

Data analysis included reviewing frequencies of learning styles and statistical analysis to that of closed-ended survey responses. Closed-ended survey question responses were reviewed for frequencies and open-ended question responses were reviewed and coded for common themes. Coding is defined by Creswell and Creswell (2018) as “the process of organizing the data by bracketing chunks…and writing a word representing a category…” (p. 193). This was done directly by the researcher. Using an inductive approach identified themes as they emerged in the data. Creswell and Creswell (2018) indicated that “qualitative researchers typically work inductively, building patterns, categories, and themes from the bottom up by organizing the data into increasingly more abstract units of information” (p. 181). Where possible, data from the same individual was integrated and reviewed using side-by-side comparison to identify any relationships between learning style, conference attendance, and opinions about educational delivery. This approach, as explained by Creswell and Creswell (2018), “will first report the quantitative statistical results and then discuss the qualitative findings (e.g., themes) that either confirm or disconfirm the quantitative results” (p. 220). Some participants did not answer every question or include identifying information on the follow-up survey, so this analysis will not be possible for every respondent. Twenty-six participants completed all parts of the study. Data were collected in the fall and winter of 2023 and 2024 and analyzed in the spring and summer of 2024.

Research Ethics

This study was submitted for review by the Bradley University Committee on the Use of Human Subjects in Research (CUHSR), or their Institutional Review Board. It was determined that the study was exempt from full review. Approval to conduct this study was granted August 21, 2023.

Informed Consent

The consent process took place electronically, wherever the participant engaged with the study (e.g., home laptop, mobile device). Participants did not need to wait to take part in the study. They received an email with a link to complete the online informed consent form. Once complete, participants received information on how to complete the first part of the study, the KELP. This included submitting their name and email address on a form with a prefilled access code that was unique to the study group. They then received an email with a unique URL to complete the assessment. There were four to six weeks between when participants completed the KELP and the second, follow-up survey. Due to span of time between engaging participants, the informed consent form was presented again as the first page of the follow-up survey to ensure the participants' understanding. They had to click "Next page" to indicate their agreement to participate. To minimize the possibility of coercion or undue influence, potential participants were only recruited via email with a maximum of three contacts (one invitation and two follow-up messages).

Data Security

Data were maintained on password-protected computers and accounts and available only to the researcher. Once collected, it was deidentified for data analysis. Survey responses collected through REDCap are password-protected and stored on secure servers. A data back-up

was stored on a secured, password-protected server. Data were maintained for approximately 1.5 years as data analysis was conducted. Once data analysis was complete, only deidentified data were maintained indefinitely for future program improvement.

Chapter Summary

This chapter described the research methodology, research context, and methods used in this action research, mixed methods study. Methods of data analysis were also discussed. The next chapter will report and discuss the study's results and findings.

CHAPTER 4: RESULTS AND FINDINGS

Chapter Introduction

This chapter includes the study's results and findings. Both results and findings address those related to hybrid meeting engagement and individual learning style preference as determined by the Kolb Experiential Learning Profile (KELP). The study was guided by the following research question: What is the relationship between surgical residents' learning style preferences and their engagement with educational content in the context of a hybrid national scientific conference?

Results

Hybrid Meeting Engagement

Quantitative survey data show that residents chose in-person learning despite virtual and hybrid modalities being available. Residents also reported satisfaction with the in-person content that was presented.

Residents Chose In-Person Learning

Resident participants showed a preference for in-person learning as compared with virtual or hybrid learning. Ninety-six percent of participants (n = 25) indicated they attended the conference in person and only one participant indicated that they attended both in person and online, however login data showed two residents each watched one session online. No one participated in the conference only by virtual means. On average, residents attended 4.7 sessions in person throughout the conference, with a range of 1 to 20 sessions attended.

When asked the main reason they chose to attend the conference the way they did, the most popular reason reported (13 participants; 50%) was the content delivery method. The next most popular answer was "Other" where participants could input answers by open-ended

response and is discussed in more detail in "Findings" below. Convenience (15.4%, *n* = 4), time (7.7%, *n* =2) and cost (3.8%, *n* = 1) were less popular answers.

Residents Did Not Engage Content Virtually

Despite 56% of participants indicating that they planned to watch content online afterward, only 7.7% (*n* = 2) of participants actually did so, based on a review of online access data. Viewing activity was limited to one session, showing that virtual content was not engaged by participants in the study period.

Residents Were Satisfied With In-Person Meeting Content

When asked about satisfaction with the content delivered, 83.8% (*n* =22) indicated they were either very satisfied or satisfied with the content presented during the meeting. Four participants (15.4%) were neither satisfied nor dissatisfied with the content presented. One participant who participated in the meeting both online and in person indicated that both methods were equally effective for learning, and one was not more effective than another.

In summary, the study found that the majority of resident participants chose in-person learning. Despite virtual and hybrid modalities being available, participants continued to gravitate towards an in-person educational experience and found this satisfactory.

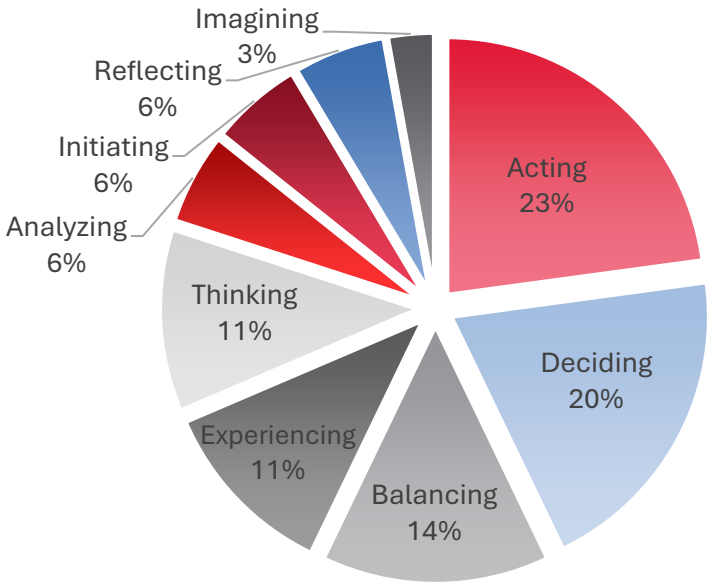
Learning Styles

As noted in chapter 3, respondents completed the KELP assessment to identify their learning style. Recall that the KELP includes nine learning styles categorized based on where the learner places emphasis in the learning cycle, whether it be experiencing, reflecting, thinking, or acting. (Kolb & Kolb, 2021). The nine styles are Initiating, Experiencing, Imagining, Reflecting, Analyzing, Thinking, Deciding, Acting, and Balancing. While there was some variation in KELP results for participants, Acting style was most common.

The results in Figure 4 depict the distribution of the learning styles among the respondents. Thirty-five participants completed the KELP. The three most prominent styles were Acting (23%, *n* = 8), Deciding (20%, *n* = 7), and Balancing (14%, *n* = 5). Less common styles included Experiencing and Thinking (11%, *n* = 4, respectively), Analyzing, Initiating, Reflecting (6%, *n* = 2, respectively), and Imagining (3%, *n* = 1).

Figure 4

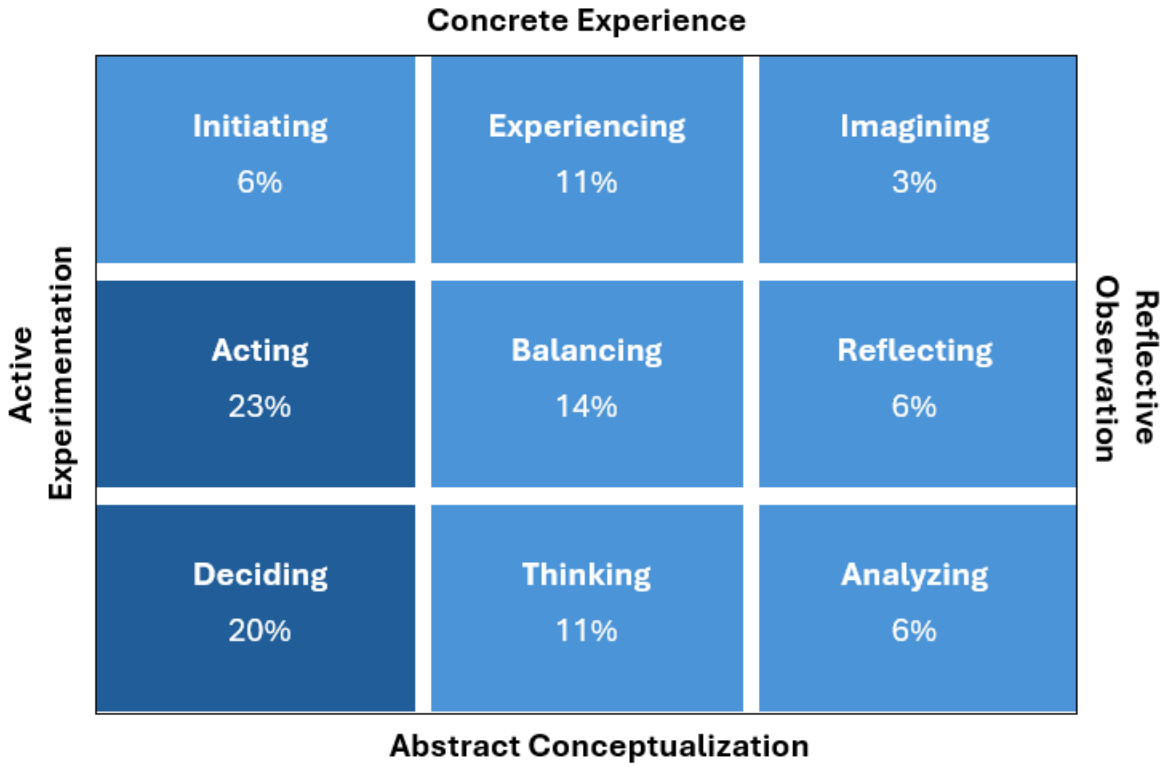
Distribution of Surgical Resident Learning Styles



Placing these learning styles as they appear in the learning cycle, is what Kolb and Kolb (2021) refer to as a learning space. Doing so, Figure 5, illustrates that the majority of residents have styles that favor more active learning.

Figure 5

Learning Space for Surgical Residents



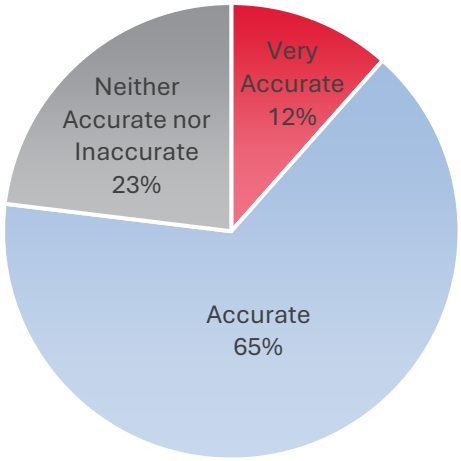
KELP Was Accurate for Residents

When asked to what extent participants thought that their individual KELP results were an accurate representation of how they, themselves, learn, 65.4% (n = 17) rated it as accurate, 23.1% (n = 6) thought it was neither accurate nor inaccurate, and 11.5% (n = 3) thought it was very accurate. This is reflected in Figure 6. No one rated the assessment as wholly inaccurate.

While 77% of residents indicated that the KELP report was accurate for them to some degree, they also reported that it did not impact how they chose to engage with content during the meeting or their future behavior. Nevertheless, residents indicated that the report provided helpful information.

Figure 6

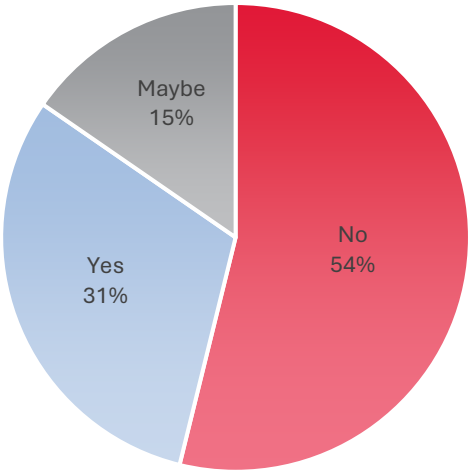
Rating of Accuracy of KELP Assessment



Participants were asked if they thought their learning style impacted how they chose to engage with content during the meeting. Their responses in Figure 7 indicate that the majority did not think their reported learning style had an impact on how they engaged with content. Their responses to this question were 53.8% (n = 14) no, 30.8% (n = 8) yes and 15.4% (n = 4) maybe.

Figure 7

Resident Response to Learning Style Impacting Meeting Engagement

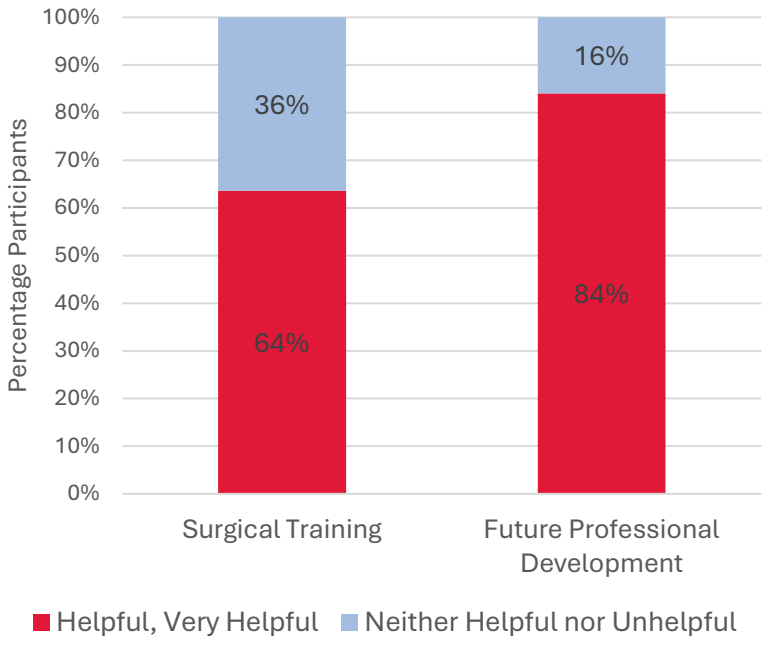


Learning Styles and Future Learning

When asked to what extent participants thought knowing their learning style would help them with their surgical training, 69.2% (n = 18) thought it would be either very helpful or helpful ("very helpful" and "helpful" answer choices consolidated) and 30.8% (n = 8) were neutral and selected that it would be "neither helpful nor unhelpful." Then, when asked to what extent participants thought knowing their learning style would help them with their future professional development, 84% (n = 25) thought it would be either very helpful or helpful ("very helpful" and "helpful" answer choices consolidated), and 16% (n = 4) were neutral and selected that it would be "neither helpful nor unhelpful." Interestingly, as seen in Figure 8, Helpfulness of Learning Style Knowledge, residents rated learning style as more helpful to know in terms of future professional development than their current surgical training.

Figure 8

Helpfulness of Learning Style Knowledge



Participants were asked if they planned to do anything differently based on knowing their learning style and the majority (69.2%, *n* = 18) did not plan to make any changes, while a third (30.8%, *n* = 8) did plan to make changes.

Summary

In summary, the results suggest that residents are interested in in-person learning. Despite virtual and hybrid modalities being available, they were rarely used by participants. Residents also reported satisfaction with the in-person content that was presented.

KELP learning styles that focused on active experimentation (Acting and Deciding) were most common among participants. Seventy-seven percent of residents indicated that the KELP results were accurate for them to some degree, however they also reported that knowing their KELP style did not impact how they chose to engage with content during the meeting or impact future behavior. Nevertheless, residents indicated that it was helpful information to know. Additionally, residents rated learning style as more applicable to future professional development, rather than current residency training.

Findings

As a complement to the quantitative results, open-ended survey responses were analyzed and coded to identify common themes. Emerging themes include practical reasons impact meeting participation, having uninterrupted time for learning is important, and meeting content raised additional questions or ideas for research.

Hybrid Meeting Engagement

Practical Reasons Impacted Meeting Engagement

Participants shared reasons for attending the meeting in the manner they did (in person, virtual, or hybrid). The most common reasons were that they were participating as a presenter,

and thus had to be there in person, they were attending committee meetings, or that the city the meeting was held in was convenient for them. To a lesser extent, respondents cited department funding their participation or attendance being required as reasons for attending the meeting in person.

Dedicated Time for Learning Was Critical

When asked what aspects of the meeting they found effective for learning, the two most common answers were an ability to focus on the material at hand without distractions and being able to engage with colleagues. Several participants specifically mentioned the ability to ask questions of presenters as being effective for learning.

As noted in the section "Residents Did Not Engage in Content Virtually," 56% of participants indicated that they planned to watch content online afterward, however, only 7.7% (n = 2) of participants actually did so based on a review of online access data. When participants were asked what they hoped to gain by viewing sessions online, they overwhelmingly indicated that they would view sessions that they missed in person. For attendees who indicated they would not watch sessions online, they cited a lack of time as the limiting factor.

Meeting Content Sparked New Ideas

Participants were asked if they planned to do anything differently based on what they learned at the meeting and the most common response was that the content sparked additional questions for follow-up, with several participants citing additional ideas for their own research projects. One participant noted that the meeting "expanded my research horizons and gave me things to think critically about related to my own research questions, methodology, and dissemination."

Learning Styles

Residents Found Aspects That Resonated With Them

Participants were asked to share their thoughts related to the KELP assessment and its accuracy. Ten participants shared unique aspects of their KELP assessment results that resonated with them and how it applied to their perception of their learning style preference. Examples included: (a) “I like to sit back and think about what I was just taught, digest it, and then put it in my own words and applications to my own experience. I can see the big picture too. I am very deliberate and analytical. I dislike a lack of structure.” (b) “The associated challenges were exactly what I struggle with.” and (c) “Very accurate. I need to be involved in scenarios to learn.”

When asked about any aspects of the KELP assessment that they did not agree with, several participants noted that their style and approach may change based on the situation and material being studied. One respondent stated, “how you answer a question can change how you’re listed as your learning style and there’s multiple ways to think about/interpret how you learn, so it doesn’t feel like a very objective means to evaluate learning styles.”

When asked to further explain if they thought their KELP learning style was reflected in how they chose to engage with content at the meeting, responses were mixed. Three participants mentioned aspects of their learning that aligned with their KELP learning style, such as they “Learn more from being actively involved” and “I like to DO, and being in person facilitates that for me.” Two mentioned aspects of the meeting that did not align with their learning style and appeared to limit learning, such as not having “much freedom in how [they] engaged with the content” and “sessions were a lot of reflecting/analyzing/thinking styles that do not reflect mine, thus leaving me feeling overwhelmed and finding it difficult to focus or participate.” One

participant shared a nuanced approach in that they thought their learning style "informs how I interact with the content, but I wouldn't said I changed how I interacted with the content based on my learning profile results." Several participants did not review the report in advance and thus were not able to respond or reflect on their KELP assessment outcome.

Learning Style Reinforced What They Already Knew

As noted above, 69% of participants indicated they would not do anything differently based on knowing their learning style. When asked to further explain their answer, the majority shared that the report reinforced what they already knew by stating that the report "confirms," their learning style, they "inherently knew," identified things they "already" do and "it was accurate, and I generally use the methods that work for me."

Summary

Findings include meeting participation was affected by outside commitments, having uninterrupted time for learning is important, and participants reported that meeting content gave them additional questions for follow-up or ideas for research. Participants reported elements of the KELP that resonated as being true for them but also mentioned that the situation may influence their learning preference and style. They also reported that overall, the KELP reinforced what they already did and used methods that worked for them. Some participants found that the conference format did not align to their learning styles.

Learning Style Comparison

Learning style as determined by the KELP assessment (not self-reported recollection) was also analyzed relative to the quantitative data. Responses from 22 participants were included in this analysis.

When comparing response frequencies to closed-ended survey questions with participants' learning styles, there was no statistical significance. However, there were two variables that approached significance ($p < .05$).

When comparing resident learning style to age and program size, both variables approached significance using Chi-Square Tests of Independence (χ^2; IBM SPSS; Oh & Pyrczak, 2023). Comparing both learning style overall to program size and age showed moderate relationships, $\chi^2 = 18.300, df = 14, p = .193$ and $\chi^2 = 27.855, df = 21, p = .144$, respectively. There appear to be modest relationships between one's learning style and age, as well as learning style and the size residency program in which a resident is enrolled. With a larger sample size, these relationships may become statistically significant.

Summary of Results and Findings

In summary, the study results show that residents prefer to participate in in-person learning, even with virtual options available. Despite virtual and hybrid modalities being available, these were seldom accessed by the participants. Residents also reported satisfaction with the in-person content that was presented.

KELP Acting, Deciding, and Balancing styles were most common among participants. Most residents indicated that the KELP inventory results were accurate for them to some degree, however they reported that it did not impact how they chose to engage with content during the meeting or would impact future behavior. Nevertheless, residents indicated that it was helpful information. Additionally, residents reported that their KELP learning style would be more applicable to future professional development, rather than current residency training.

Residents reported their meeting participation was impacted by other responsibilities. Resident participants also shared that focused time for learning is critical, and that meeting

content provided questions for follow-up or ideas for future research. Participants reported elements of the KELP that resonated as being true for them but also mentioned that the situation may influence their learning style and preferences. They also reported that overall, the KELP reinforced what they inherently knew and were already using effective methods.

Chapter Summary

This chapter summarized the study results and findings including the participants' responses to the quantitative and qualitative queries, relationship with engagement in a hybrid meeting, and KELP learning styles. Chapter 5 will summarize the study overall, provide discussion and analysis, answer the study's research question, propose implications for practice, and offer recommendations for future research.

CHAPTER 5: DISCUSSION

Chapter Introduction

The purpose of this study was to uncover surgical residents' learning style preferences and illuminate how they engage with educational content in the context of a hybrid national scientific conference. The study was guided by the following research question: What is the relationship between surgical residents' learning style preferences and their engagement with educational content in the context of a hybrid national scientific conference? While information regarding learning style was viewed as helpful and accurate, surgical residents did not think it impacted how they engaged with content. The Acting learning style was most prevalent among participants. While residents planned to view educational content online later, they rarely did so. This chapter will provide a summary of the study, analysis and discussion of results and findings in the context of relevant literature, answer the study's research question, discuss implications for practice, identify limitations of the study, and suggest areas for future research.

Study Summary

This study aimed to review the learning style preferences of surgical residents in the context of a hybrid national scientific conference. In the wake of the COVID-19 pandemic, education delivery changed rapidly and impacted surgical residents uniquely given the point in their training this disruption occurred (Ellison et al., 2020). This study used the KELP to determine the learning style of 35 surgical residents who were registered for a hybrid scientific conference in fall 2023. Participants took the KELP and then attended the conference. Following the meeting, they completed a survey that asked about their engagement with educational content and what impact, if any, their learning style from the KELP had on how they approached the

meeting. Results from the KELP showed that the most common learning style was Acting which is defined by action toward a goal that combines duties and people.

Participants indicated a preference for in-person learning and noted its unique attributes such as engaging with colleagues and asking follow-up questions of presenters. While residents were satisfied with the content, they did not think that their learning style impacted how they engaged with content. They thought knowing their learning style would help with their future training, and even more so with their future professional development. While most participants thought the KELP assessment was accurate, they did not plan to change their behavior based on knowing their learning style because it reinforced what they intuitively knew about how they learn.

When learning style was compared to resident age and program size, the relationship approached significance, which suggests that there may be an underlying difference in the selection of residents based on program size, that residents with certain learning preferences seek out certain programs, or develop certain styles while in those programs. Learning style may also evolve as residents progress though training and gain experience.

Analysis and Discussion

Hybrid Meeting Engagement

Resident motivation for attending a scientific conference included the content delivery method as a primary driver as well as practical realities such as attendance requirements, including presenter and committee meeting obligations. Despite the prevalence and accessibility of online learning, no one in the sample chose to consume content exclusively online, showing a preference to learn in person. Participants cited an ability to focus, free from distractions, and engaging others as the benefits of learning in person. This aligns with previous findings of

Hameed et al. (2021) who found that networking was preferred in person as well as (Cassidy et al. (2023) and Ellison et al. (2020) who found that engagement suffered in a virtual format.

While a majority of participants indicated that they intended to watch sessions online, the number who actually did so was extremely low, which suggests that the limiting factor of time, as cited by many residents, was a significant barrier toward revisiting content. It might also be that their satisfaction with the in-person portion met their professional needs, or that they did not need to reference the meeting material within the study timeframe. In the wake of the COVID-19 pandemic, hybrid meetings gained in popularity with residents (Hameed et al., 2021), however, this study shows that by 2023, when given the option, in-person learning is chosen more frequently. Preferences for in-person learning could also be a lingering result of pandemic restrictions with a renewed appreciation for being together with others.

Learning Style

The most common KELP learning styles among participants were Acting and Deciding. This aligns with previous studies where styles focused on active experimentation in the Kolb model were more common in surgery residents as found by Quillin et al. (2013) and Engels and de Gara (2010). The Acting style "is characterized by a strong motivation for goal directed action that integrates people and tasks" (Kolb & Kolb, 2021, p. 14) which describes the field of surgery well.

When study participants were asked if they planned to do anything different based on now knowing their learning style, 69% indicated they did not. Resident participants indicated that their learning styles aligned with what they already implicitly knew, reinforced what they already did, and thus no change was necessary. This finding suggests that learners at this level (residency) have already developed preferences and actions that are effective and work for them,

and that the KELP largely just validated those efforts. Seventy-seven percent of participants thought the learning style was an accurate representation of how they learn, which provides validation for the instrument. A majority of participants did not think their KELP learning style impacted how they engaged with content. While 69% of residents thought that knowing their learning style would help them in their current training, 84% thought it would help in future professional development. This suggests that the fairly structured environment of residency training leaves little room for adaptation based on learning style preferences, whereas later professional development offers more variability and they may make different choices based on knowing their learning style preference. These findings might help inform future conference planning. While it might be impossible to meet the learning styles of every participant, thought could be given to offering a variety of delivery methods and formats so that participants can find what works for them, making the meeting and content delivered as useful and impactful for all who attend.

While not statistically significant, there is a trend toward significance between age and program size with regard to learning style. Similarly, both Richard et al. (2014) and Lai et al. (2014) also found a relationship between age and learning style. Participants in this study tended to move through the learning cycle toward styles associated with active experimentation as they grew older and gained more experience. The relationship between program size and learning style is not otherwise evident in the literature. It is unclear if there is perhaps an underlying characteristic that brings residents with a particular learning style toward larger programs, or whether they adapt a learning style once they are in that learning environment.

Answer to the Study's Research Question

This study intended to answer the following research question: What is the relationship between surgical residents' learning style preferences and their engagement with educational content in the context of a hybrid national scientific conference? Findings indicate that residents, across all KELP learning styles, still want to learn in person. Focused, dedicated time for learning that is free from distractions with the opportunity to engage with colleagues are the primary benefits to this learning modality. Despite hybrid learning being available for learning, few residents used this option, regardless of KELP learning style and no one chose to access content only virtually.

Acting and Deciding learning styles were prevalent, which is consistent with other relevant studies. Results of this study suggest that sophisticated learners, such as surgical residents, have developed over time learning methods that work best for them and knowledge of their learning style has little immediate impact on how they choose to engage with content and learn. In addition, a majority do think that knowing one's learning style could have an impact on later professional development suggesting an impact by educational setting. As residents move from a more controlled environment of training to one of independent practice, they may view personal learning style as more relevant. Since learning style largely aligned with the participating residents' current practice, they were unlikely to make a change based on this new information. Practical factors also have an impact on how residents engage in large, national scientific meetings, such as professional obligations, like presentations, committee meetings, or even meeting location. Overall, the study did not find that a resident's KELP learning style was directly related to the way they engaged with content at a hybrid national scientific conference.

Age and program size were two attributes that approached significance in relation to learning style, suggesting that there is a difference in learning style between small, medium, and large programs, and also that learning style evolves as residents progress through training.

Implications for Practice

In-person learning continues to play an important role in the lifelong learning and professional development of surgery residents. As the majority of participants engaged in person, focus should be made toward making this delivery format as effective as possible. Kolb and Kolb (2021) note that a primary implication of ELT is the ability to promote deeper learning through thoughtful design of education that can reach learners where they are in the learning cycle. Surgical residents have more active learning styles which suggests that adapting in-person learning to include experiential learning methods, such as workshops, discussions, case studies, simulation, and hands-on learning may engage the learner differently and be more impactful and well-received (Wurdinger & Carlson, 2010).

Further, personalizing meeting content delivery to different learning styles could make learning more efficient and effective. This may even be accelerated by utilizing artificial intelligence (Fadel et al., 2024). Residents noted that knowledge of their learning style was helpful and anticipated its application in future professional development, rather than their current training. Learners may also benefit from knowledge of their learning styles to focus their learning efforts. Equipping learners with this information, not only puts learners at the center, but engages them in a way to direct their own learning. Further educating faculty and conference planners about how learners best engage with content may help in developing education that is impactful for the learner.

While participants planned to view sessions online, virtual sessions were seldom viewed following the meeting. What learners think they will do, or plan to do, is not what is occurring. This suggests that improvements could be made to engage learners in this medium or repurpose online content in a more meaningful way. Furthermore, participants identified the biggest barrier to viewing sessions later was time. While online access to educational content is common postpandemic (Cassidy et al., 2023), this type of content should be offered in a way they will use. To address the obstacle of time, utilizing a microlearning approach could be effective (Ouellet et al., 2025). Focused time of 60-90 minutes might be feasible for an in-person setting, however, this approach could be adapted for learners who are integrating learning into busy training and practice schedules. Breaking larger sessions into smaller chunks can allow the learner to find content that is of most interest and make the best use of their limited time. Additionally, content could be delivered via a spaced learning approach which has shown to be effective by learning knowledge or skills at defined intervals over time (Martinengo et al., 2024). Conducting a needs assessment for this learner group could help identify areas for improvement overall. Improving in-person learning through more active approaches, educating learners on their learning preferences, and enhancing online learning postconference are some implications of this study.

Limitations

This study has several limitations. The low number of participants limits the broad applicability of its findings. Having additional participants would have increased the statistical power of the study (Oh & Pyrczak, 2023). Identifying information was not available for all participants who completed the follow-up which limited the number of participants whose survey responses could be connected with their KELP assessment results. A convenience sample of

residents was used rather than a truly random sample of all residents, which could have influenced the residents who elected to participate. This also increased the risk of sampling errors impacting the results disproportionately (Oh & Pyrczak, 2023). Recruitment materials were sent to all registered residents to reduce unanticipated bias. Finally, the participants were disproportionately women which is not representative of the surgery resident population, which in 2023-2024 was approximately 51% men to 49% women which could have influenced the results (Association of American Medical Colleges, 2024).

As with any survey method, responses are a self-reported snapshot in time and free response comments may be open to interpretation (Mertler, 2020). Program size was self-reported and responses were grouped by the researcher which could lead to imprecision of that variable. Closed-ended questions were also used to offset this limitation.

This study used the latest version of the Kolb inventory, of which there are not many other comparative studies in this research population. Further, learning styles are not known to be fixed, but can change, and could depend on the situation. Caution should also be exercised when reviewing other applications of the KELP results as the instrument is "not a criterion-referenced test and is not intended for use to predict behavior for purposes of selection, placement, job assignment, or selective treatment" (Kolb & Kolb, 2021, p. 38). Lastly, the number of learning styles in this inventory, nine, can divide the sample, requiring higher numbers of participants to achieve statistically significant results. The small number of participants, nature of survey research methods, and limitations of learning styles are some shortcomings of this study.

Suggestions for Future Research

This study leads to many additional avenues for future research. A study with larger samples may reveal stronger relationships between learning style preference and program size, which could explore an underlying quality in resident selection.

Further research in using this new KELP version with the additional nuanced learning styles should be explored to further illuminate the learning styles of surgery residents through this updated instrument and framework. As previously noted, learning style is a preference which can change and evolve, so additional research in this area would be worthwhile.

Lastly, practical use of learning style information and ELT in developing and delivering educational content could be explored. For example, Snyder (2025) recently explored how experiential learning design could be enhanced using generative artificial intelligence (AI) and prompt engineering. As extended reality (XR) technologies improve and become more widely adopted, investigating these applications in the context of a hybrid national scientific conference could be valuable and lead to worthy insights and new directions (Woodall et al., 2024).

Conclusion

The purpose of this study was to uncover surgical residents' learning style preferences and their engagement in educational content in the context of a hybrid national scientific conference. The study found that residents tend to have Acting learning styles, which blend hands-on tasks and working with people toward a particular goal. While residents thought knowing their individual learning style was helpful, they also reported that it aligned with how they already learned and were unlikely to change their behavior. While residents planned to view sessions online following the conference, few did so, revealing an opportunity to improve online

education and engagement subsequent to an in-person conference. Additional research into the nexus of learning style, program size, and age is worthy of additional research.

This latest version of the KELP allows for further nuance and understanding to further uncover how residents learn best so that environments can be shaped to maximize where learners are in the learning cycle. While the COVID-19 pandemic ushered in many new learning methods and technologies, residents still see the benefits of engaging in-person to learn and offering education in a way that is adaptable could make the learning experience more personalized, engaging, and impactful.

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APPENDIX A:

LETTER OF INVITATION

Greetings:

I am an ACS Staff Member and doctoral student at Bradley University. I am reaching out to invite you to participate in a research study investigating the relationship between the learning styles of surgical residents and engagement in educational content at ACS Clinical Congress 2023.

Participants in the study will be asked to complete the online Kolb Experiential Learning Profile (KELP), which takes approximately 10-15 minutes to complete. You will then receive a personalized learner profile based on your responses. After Clinical Congress, you will receive a brief online survey asking your opinions about the meeting content and how you chose to participate in the meeting. Following Clinical Congress, attendance data will be reviewed. Your participation is completely voluntary and you may withdraw your participation at any time. Your participation is not required by the American College of Surgeons and is unrelated to any responsibilities as a meeting attendee.

Questions about this study may be directed to the Student PI in charge of this study: Rachel Williams Newman, MS, [Student Email Address], [Phone Number], or the faculty advisor, T. Scott Estes, Ed.D., [Advisor Email Address], [Phone Number]. If you have general questions about being a research participant, you may contact the Bradley University Committee on the Use of Human Subjects office at (309) 677-3877.

The American College of Surgeons has granted permission for this study.

If you are interested, please submit your name and email address in this form [form linked]. Please feel free to contact me with any questions.

With kind regards,

Rachel Williams Newman, MS
[Student Title]
American College of Surgeons
Doctor of Education Student, Bradley University
[Student Email Address]
[Phone Number]

APPENDIX B:

INFORMED CONSENT

Study Title: Surgical Resident Learning Style and Hybrid Scientific Conference Preferences

You are invited to participate in a research study. The purpose of this study is to examine the relationship between learning style and engagement in education by surgical residents. If you agree to take part in this study, you will be asked to complete the online Kolb Experiential Learning Profile, provided by the Institute for Experiential Learning, which takes approximately 10-15 minutes. You will then receive a personalized report via email with your results and your learning style. The Institute for Experiential Learning may also reach out to you for feedback on the report. After Clinical Congress, you will receive a brief online survey asking your opinions about the educational content you participated in, how you chose to participate in the meeting, and your motivations for engaging in content in the way you chose. This is expected to take 10-15 minutes, for a total of about 20-30 minutes over the two interactions. Basic demographic information will be collected; however, it will be confidential and reported only in the aggregate. Your meeting attendance data will be reviewed following the conclusion of the meeting. Taking part in this study is voluntary. You may choose not to take part, many skip specific questions, or may leave the study at any time. Your participation is not required by the American College of Surgeons and is unrelated to any responsibilities as a meeting attendee.

We plan to publish the results of this study. To protect your privacy, we will not include any information that can directly identify you. Your name and any other information that can be used to identify you will be stored separately from the data collected for this research study. The software used for the survey is HIPAA-compliant and your information will be stored on password-protected computers. Other people may need to see this information. They include the faculty advisors or ACS staff. After the study is over, only deidentified data will be maintained for future research or quality improvement projects.

Risks or discomforts from this research are not expected to exceed those experienced in daily life. The study will provide you with a personalized Learning Style Profile, which you may find beneficial.

Questions about this study may be directed to the Student PI, Rachel Williams Newman, MS, in charge of this study: [Student Email Address], or [Phone Number], or the faculty advisor, T. Scott Estes, Ed.D., [Advisor Email Address], [Phone Number]. If you have general questions about being a research participant, you may contact the Bradley University Committee on the Use of Human Subjects office at (309) 677-3877.

You are voluntarily making a decision to participate in this study. Your submission of the assessment means that you have read and understand the information presented and have decided to participate. Your participation also means that all of your questions have been answered to your satisfaction. If you think of any additional questions, you should contact the researcher(s).

APPENDIX C:

FOLLOW-UP SURVEY INSTRUMENT

Thank you for taking the time to complete this survey. Please answer the following questions about your experience engaging with educational content during the recent ACS Clinical Congress.

1. How did you attend the ACS Clinical Congress?
   - In person (in Boston, MA)
   - Virtually (attended any session online, either livestream or on demand)
   - Both in person and virtually

2. What was the main reason you chose to attend Clinical Congress in the way that you did (e.g., in person, virtually, both)? Select all that apply.
   - Time
   - Convenience
   - Cost
   - Content Delivery Method
   - Other, please explain:

[If respondents selected “in person” to Q1, they will get these two questions.]

3. What aspects of attending the meeting in person did you find effective for learning?

4. Since you attended in person, do you plan on accessing content online at a later date?
   - Yes
   - No

   If yes, what do you hope to gain by viewing sessions online?

   If no, why not?

[If respondents selected “virtually” to Q1, they will get this question.]

5. What aspects of attending the meeting virtually did you find effective for learning?

[If respondents selected “both” to Q1, they will get these three questions.]

6. Did you find one delivery method more effective than another?
   - In-person was more effective
   - Virtual was more effective
   - Both in-person and virtual were equally effective

7. What aspects of attending the meeting in person did you find effective for learning?

8. What aspects of attending the meeting virtually did you find effective for learning?

9. Overall, how satisfied were you with the content presented?
   - Very satisfied
   - Satisfied
   - Neither satisfied nor dissatisfied
   - Dissatisfied
   - Very dissatisfied

10. Do you plan to do anything differently based on what you learned during the meeting?

[Next page]

Please answer the following questions about the Kolb Experiential Learning Profile (KELP).

11. Based on the KELP, what was your learning style?
   - Initiating
   - Experiencing
   - Imagining
   - Reflecting
   - Analyzing
   - Thinking
   - Deciding
   - Acting
   - Balancing
   - I don't recall
   - I didn't look at my personalized report

[If they select, "I didn't look at my personalized report," skip this question.]

12. Overall, to what extent is KELP an accurate representation of how you learn?
   - Very accurate
   - Accurate
   - Neither accurate nor inaccurate
   - Inaccurate
   - Very inaccurate

[If they select, "I don't recall," or 'I didn't look at my personalized report," skip questions 13-14.]

13. What, if any, aspects of your KELP personalized report or learning style resonated with you as being true to how you learn?

14. What, if any, aspects of your KELP personalized report or learning style did you not agree with?

15. Do you think your learning style impacted how you chose to engage with content during Clinical Congress (in-person, virtually, both)?
    - Yes
    - No
    - Maybe

    Please explain:

16. To what extent do you think knowing your learning style will help you with your surgical training?
    - Very helpful
    - Helpful
    - Neither helpful nor unhelpful
    - Unhelpful
    - Very unhelpful

17. To what extent do you think knowing your learning style will help you with your future professional development?
    - Very helpful
    - Helpful
    - Neither helpful nor unhelpful
    - Unhelpful
    - Very unhelpful

18. Do you plan to do anything differently based on knowing your learning style?
    - Yes
    - No

    Please explain

19. Please share any other comments:

20. Email Address (please use the same email address you used to register for Clinical Congress):

21. Name:

[Next page]

The following questions gather some demographic data.

22. Residency Program Type:
    - University
    - Independent
    - Military

23. Program Size:

24. Please select your PG Year:
    - PGY 1
    - PGY 2
    - PGY 3
    - PGY 4
    - PGY 5

25. Gender Identity (select all that apply):
    - Woman
    - Man
    - Transgender
    - Non-binary/non-conforming
    - Prefer not to respond

26. Age