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Virtual objective structrued clinical examinations as a framework for active learning and assessment: a retrospective analysis of Dental Hygiene student and instructor perceptions

Kellie Whitcomb

Virtual Objective Structured Clinical Examinations as a Framework for Active Learning and Assessment:

A Retrospective Analysis of Dental Hygiene Student and Instructor Perceptions

A Thesis

Presented in Partial Fulfillment of the Requirements for the

Degree of Master of Science

in

Dental Hygiene

in the

College of Graduate Studies

Eastern Washington University

by

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Spring 2021

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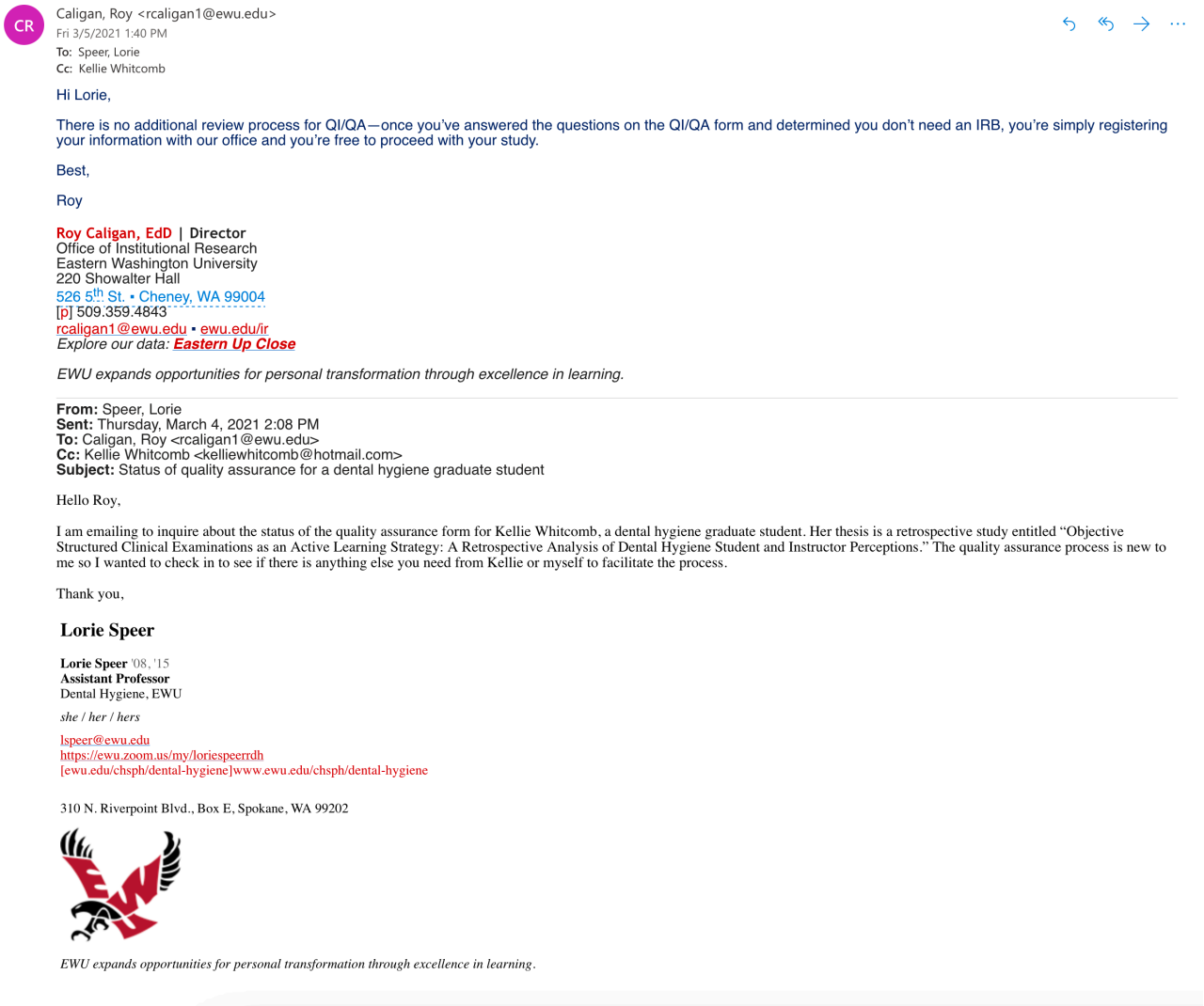
Human Subjects Approvals

This Quality Assurance project was registered with the Eastern Washington University Office of Institutional Research. Quality Assurance projects do not require review and approval by the Institutional Review Board for Human Subjects Research.



CR

Caligan, Roy <rcaligan1@ewu.edu>
Fri 3/5/2021 1:40 PM
To: Speer, Lorie
Cc: Kellie Whitcomb

Hi Lorie,

There is no additional review process for QI/QA—once you've answered the questions on the QI/QA form and determined you don't need an IRB, you're simply registering your information with our office and you're free to proceed with your study.

Best,

Roy

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From: Speer, Lorie
Sent: Thursday, March 4, 2021 2:08 PM
To: Caligan, Roy <rcaligan1@ewu.edu>
Cc: Kellie Whitcomb <kelliewhitcomb@hotmail.com>
Subject: Status of quality assurance for a dental hygiene graduate student

Hello Roy,

I am emailing to inquire about the status of the quality assurance form for Kellie Whitcomb, a dental hygiene graduate student. Her thesis is a retrospective study entitled "Objective Structured Clinical Examinations as an Active Learning Strategy: A Retrospective Analysis of Dental Hygiene Student and Instructor Perceptions." The quality assurance process is new to me so I wanted to check in to see if there is anything else you need from Kellie or myself to facilitate the process.

Thank you,

Lorie Speer

Lorie Speer '08, '15
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Abstract

Purpose: Millennials have unique needs as learners and have come to expect the use of technology in education. Utilizing technology to implement formative virtual objective structured clinical examinations (vOSCEs) may engage millennial students due to the non-linear nature and active pedagogy while also preparing them for provisional or full licensing exams. The purpose of this study was to determine what implications there may be for future formative vOSCE use in dental hygiene programs by assessing dental hygiene student and clinic faculty experience with vOSCEs.

Methods: Research was from a qualitative perspective. The design was a retrospective phenomenological cohort study utilizing respondent validation, methodological triangulation, and bracketing to minimize validity threats.

Results: Analysis of the data produced three main themes: wellbeing, process evaluation, and critical thinking. Virtual OSCEs may contribute to the wellbeing of students and faculty in relation to ergonomics and feelings of gratitude for the experience. Virtual OSCEs may also contribute to the development of critical thinking due to student verbalization of psychomotor skill, immediate feedback, and grading.

Conclusion: The essence of the vOSCE can be described as an overall positive experience with support for incorporating this formative assessment into dental hygiene program clinical curriculum. The theoretical implication of this study is that virtual OSCEs are a viable active learning and assessment strategy that may foster critical thinking development for millennial students and enhance the wellbeing of faculty and student participants. Practical implications for future vOSCE use in dental hygiene programs related to process evaluation were identified.

Acknowledgements

With humility, I would like to express my sincere gratitude to the members of my Thesis Committee, Lorie Speer RDH, MSDH, Lisa Bilich RDH, MSEd, and Donita Torres Ph.D., in addition to Merri Jones RDH, MSDH for their continual encouragement and guidance through their insightful comments and suggestions. I'd like to offer a special thank you to Donita Torres Ph.D. for investing her time and knowledge into shaping my understanding of qualitative data analysis. Your collective mentorship has been valuable to me both professionally and personally. I respect and admire your contributions to the profession of dental hygiene and education. You are all impactful leaders in our field and I am so honored to have been guided by you through my educational journey.

I would like to extend my sincere thanks to Marilynn Rothen, RDH, MS for introducing me to research 18 years ago while working under her supervision at University of Washington's Regional Clinical Dental Research Center. She was the first to show me that it was possible to be a registered dental hygienist and also a researcher. She inspired me to believe that research can be fun! I do think it is a thrilling, if at times tedious process with rich reward. Most of all, I am deeply grateful for her advice so long ago to say 'yes' to opportunities as they present, even if you've not done it before, and to rest in the knowledge that you will learn how to do it along the way.

To Associate Dean Cindy Ko RDH, MEd and the clinical faculty of my hosting institution, I would like to offer genuine appreciation for their unwavering support and

belief in me as a colleague and educator. I would like to express a special thank you to Danette Lindeman RDH, MEd for the professional and personal mentorship we share that reassures and emboldens my creativity in developing meaningful teaching and learning experiences. I am also grateful to the students and faculty members who provided valuable insight into the experience of virtual objective structured clinical examinations. I am thankful for their trust in me to implement an innovative teaching and learning activity while in the midst of a pandemic.

Finally, I would like to extend my utmost gratitude to my husband and children. Without their support, encouragement, and tremendous understanding over the past few years, it would have been a difficult task to complete all my studies.

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Introduction/Literature Review

Introduction to the Research Question

The American Dental Association's Commission on Dental Accreditation (CODA) states in Standard 2-23 that dental hygiene programs must develop graduates who are "competent in problem solving strategies related to comprehensive patient care and management of patients" (Commission on Dental Accreditation, 2019). To develop this competency, educational programs are challenged to engage in learning and teaching methods that cultivate higher level critical thinking. Active learning has been established as a mechanism to foster critical-thinking skills (Bonwell & Eison, 1991; Michel et al., 2009). Formative Objective Structured Clinical Examinations (OSCEs), where instructors observe and provide feedback related to students' skill via simulation, may be an appropriate addition to dental hygiene curriculum due to simulation's relationship to critical thinking development (Brazeau et al., 2002; Chisnall et al., 2015; Tedesco-Schneck, 2013; Zahid et al., 2016).

Statement of Problem

Millennials and Generation Z are the current traditional age college students (Parker & Igielnik, 2020), and have grown up using technology and have come to expect the use of technology in education (Beebe et al., 2014). Unlike Generation X and Baby Boomers, Millennials seek the motivation to learn from their instructors and classmates rather than from their own internal desire to learn (Beebe et al., 2014). Student-centered and evidence-based educational programs are charged to consider a new approach from traditional teaching and learning in order to fully engage this group of students.

Formative OSCEs are an example of problem-based learning, which utilizes active rather than traditional passive, lecture-based teaching methods. Objective Structured Clinical Examinations (OSCEs) have been associated with improved performance on subsequent identical summative OSCEs (Chisnall et al., 2015). In 33 states, OSCEs are an alternative form of examination to live patient single encounter exams for provisional and initial dental hygiene licensure (The Commission on Dental Competency Assessments, 2020). Utilizing technology to implement formative OSCEs may engage Millennial students due to the non-linear nature and active pedagogy while also preparing them for provisional or full licensing exams.

The goal of this retrospective cohort analysis was to assess dental hygiene student and clinic faculty experience with OSCEs administered virtually via Zoom to determine what implications there may be for future formative OSCE use in dental hygiene programs. This goal was reached by answering the following related questions: Would an orientation to introduce and describe successful OSCE implementation and participation be effective? What aspects of the OSCE worked well and what did not? What would participants like done differently? Would participants recommend the continuation of OSCEs for future dental hygiene students?

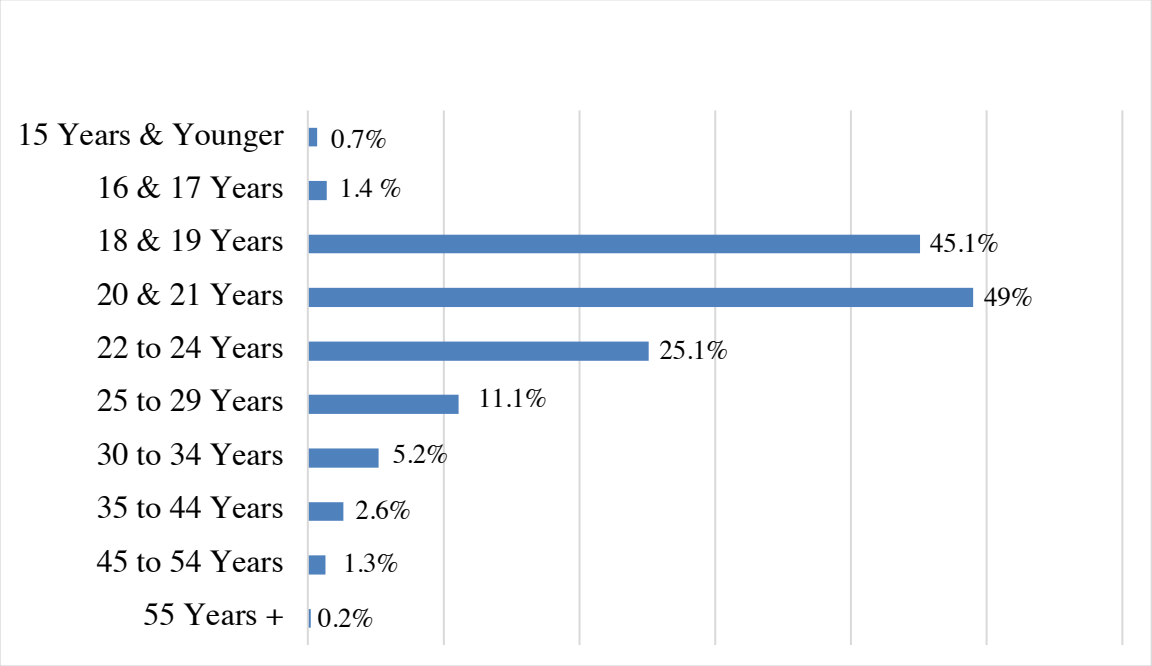
This study supports the National Dental Hygiene Research Agenda priority area, education research: evaluating educational models (Lyle et al., 2016). This research was important for the purpose of evaluating OSCEs as an active learning and strategy and for contributing to the current gap in knowledge related to student and faculty perceptions of formative OSCEs in dental hygiene programs.

Overview of Research

Adapting teaching and assessment styles to students' learning style increases student agency, ability to critically think, and overall achievement of learning outcomes (Billings & Halstead, 2016; Huba & Freed, 2000; Rotenberg, 2010). Learners on campus as of 2019 were between the ages of 15 and 55+, with the highest percentage of learners being between the ages of 18-24. This age group falls within an age range described as the millennial generation, but may also apply to early Gen Z (see Figure 1) (Bustamante, 2019; Parker & Igielnik, 2020). Due to the lack of scientific study on Gen Z, the focus of this research will be on the millennial generation.

Figure 1

College Enrollment by Age



Note. From Bustamante, 2019 and Parker & Igielnik, 2020

There is evidence that millennials approach learning differently than previous generations, which has caused educators to evaluate current teaching methods to evolve

or adapt them altogether (Battersby, 2017; Beebe et al., 2014; Djiwandono, 2017; Weiler, 2004). Millennial student and faculty perceptions of utilizing formative OSCEs has been documented with reassuring results. Both have found the OSCE to be a meaningful and fair assessment tool for developing both critical thinking and clinical skills (Alsaid & Al-Sheikh, 2017; Lim et al., 2020; Nasir et al., 2014; Nazzawi, 2018; Pugh et al., 2018; Puryer, 2016).

Millennial Learners

Grouping people within generations provides researchers an opportunity to view a cohort born within a similar time period who have shared influential experiences. World events, political economy, family, personal values and beliefs, pace of life, community, culture, and commerce shape these experiences (Beebe et al., 2014; Dimock, 2019; Howe & Strauss, 2000). An example of this would be the early lives of the millennial generation which was influenced by international and national terrorism and the war on drugs (Battersby, 2017; Beebe et al., 2014).

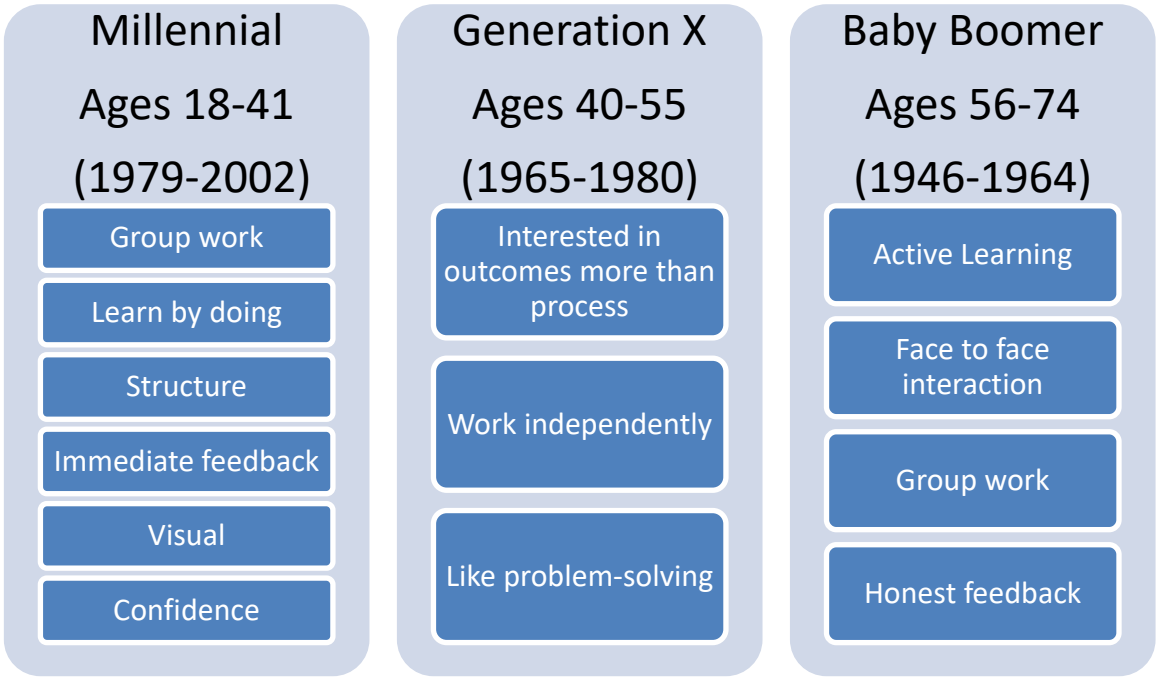
Generational birth years are not an exact science, yet it is helpful to define cohorts in order to produce meaningful analytics. Pew Research Center defines millennials, also called Generation Y or Net Gen, as those born between 1981 and 1996 (Dimock, 2019). Others describe this group as being born between the years of 1980 and 2001(Beebe et al., 2014; Djiwandono, 2017). Still others claim 1979 being the first birth year of inclusion (Billings & Halstead, 2016) and the last year of inclusion as 2002 (Howe & Strauss, 2000). Even with uncertain birth year boundaries, the millennial generation is equivalent in age span to the preceding Generation X (Dimock, 2019). Based on this information, millennials are considered to be between the ages of 18 and 41.

Understanding generational differences may help educators improve their teaching effectiveness. To better understand the needs of students, several studies have focused on the learning traits of millennials. These college students have grown up during the late Information Age utilizing technology. They are proficient with computers and software, mobile phones, gaming devices, and the internet. Information technology has impacted their culture so much so that they have come to expect it in every aspect of their lives, including education (Billings & Halstead, 2016; Blue & Henson, 2015).

Blue and Henson (2015) describe millennials' characteristics and expectations for the learning environment, which would be described as including less lecture, active learning approaches, use of multimedia, and collaborating with peers in the classroom. Millennials thrive with structure and clear plans in coursework. They prefer to know facts related to core knowledge, desire for their learning to be relevant and related to their experiences and expect frequent feedback. Millennials have difficulty seeing the big picture and often need their educators to make the connection between their life and course learning. These students will learn best when receiving new materials multiple times and in different ways. Millennials expect multimedia in the classroom, and the instructors who do may likely see better student test scores on quizzes and examinations (Blue & Henson, 2015; Djiwandono, 2017; Wilson & Gerber, 2008).

Figure 2

Learner Characteristics by Generation



Note. Battersby, 2017; Beebe et al., 2014; Blue & Henson, 2015; Dimock, 2019; Djiwandono, 2017; Howe & Strauss, 2000; Weiler, 2004; Wilson & Gerber, 2008

Another study sought to understand information-seeking motivation, critical thinking, and learning theory of millennials, also called Generation Y students (Weiler, 2004). This research found that a small percentage of students prefer to learn by reading. Instead, they prefer hands-on learning activities to hold their interest and increase information retention. Generation Y students are concerned with saving time and appreciate when time-saving aspects, such as Boolean operators and filters for search, are shared with them. Instead of passive lecture, these students prefer active discussion through questions being raised (Weiler, 2004).

A literature review of millennial students, action-oriented learning, collaborative classrooms, and dental hygiene educators was conducted to determine education

strategies that best engage Generation Y students (Battersby, 2017). This systematic review confirmed that learning characteristics of this generation of students differed from those before, and therefore teaching strategies that may have worked in the past may no longer be effective. The evidence suggested that educators must incorporate interactive activities, experiential learning, and the provision of information in short segments. Application of these strategies may include incorporating technology through the use of video, specific learning software, classroom clickers, and e-textbooks. Other strategies include service-learning experiences, mind mapping, games and puzzles, simulations, debates, and case-based learning (Battersby, 2017).

Evidence has proven millennial students thrive in active-learning environments. This poses a challenge for faculty to examine traditional pedagogy. Barriers exist to implementing active pedagogy, including student and faculty resistance, inadequate time, heavy teaching loads, and required administrative and scholarship duties (Tedesco-Schneck, 2013). However, actively engaging students in learning can significantly enhance learning in all domains (Ismail & Groccia, 2018).

Passive Versus Active Learning Pedagogy

Traditional teaching methods, which is predominantly passive, can be described as the delivery of course content in the form of lectures from the professor who is looked upon as a content matter expert. The majority of assessments are tests in multiple choice, true-false, or matching question format. Passive lecture allows the educator to impart knowledge and introduce basic principles to large classes sizes in a relatively short period of time. With lecture being the majority of class time, there is often minimal time for student input through discussion or classroom activities (Harris & Bacon, 2019; Michel et

al., 2009). Tedesco-Schneck (2013) harshly describes passive learning in the form of lecture as "listless transfer of information from professor to student focusing on memorization of content which emerged from another's thinking" (p. 58). There are drawbacks to passive learning, including students failing to retain material after the class has been completed and lack of student attention during class, including talking with each other or falling asleep, playing games or messaging on their electronic devices (Michel et al., 2009).

In contrast to traditional teaching methods where students passively receive information from the instructor, active learning involves effort and engagement with learning materials and requires application of the student's prior experiences and beliefs. The depth and extent of engagement is related to the depth and extent of learning achieved (Ismail & Groccia, 2018). In essence, active learning is a broad term used to describe multiple methods of instructional strategies that hold students responsible for their own learning (Harris & Bacon, 2019).

An empirical study compared active versus passive teaching styles on student learning outcomes (Michel et al., 2009). Their findings indicated that a passive, lecture style approach to learning broad subject matter had no significant differences compared to active learning. However, once students had a base knowledge of subject matter, there was a significant advantage to engaging students in an active learning approach with class-specific learning outcomes (Michel et al., 2009). This implies that in some contexts, as in advanced theory and practice courses, active learning has a positive influence on student learning.

Active learning pedagogy can be described as introducing student activity into the traditional lecture to promote student engagement (Prince, 2004). Active learning includes numerous instructional techniques. Variations can be seen in Figure 3, including experiential learning (Kolb, 1984), problem-based learning (PBL) (Miller, 2004), participative learning (Mills-Jones, 1999), and cooperative learning (Johnson et al., 1991). In a clinical setting, active learning strategies include experiential and problem-based learning (PBL). The latter, in particular, shows a statistically significant improvement on students' clinical performance due to the promotion of critical and evaluative thinking (Prince, 2004).

Harris and Bacon (2019) conducted a systematic review of the literature to determine whether active learning was more successful than passive learning at producing cognitive skills in health care profession students. Their research grouped active learning strategies by lower-order thinking and higher-order cognition (see Figure 3). Lower order cognition includes tasks such as the ability to remember, understand and apply knowledge in classroom settings. Higher-order cognition includes tasks such as analyzing, evaluation, and creating which underlie the ability to critically think and problem solve successfully as students transition from the classroom to clinical practice (Harris & Bacon, 2019).

Figure 3

Active Learning Strategies by Order of Cognition

Low-order Cognition *Remember, Understand, Apply*	High-order Cognition *Analyze, Evaluate, Create*
Game-based learning (GBL) • Effective in reviewing and summarizing information • Examples are puzzles, crosswords, or online games	Problem-based learning (PBL) • Also known as case-based learning • Implementation varies widely • Consistently produces positive student attitudes • Results in significant improvement in clinical performance • Promotes better study habits • Promotes critical and evaluative thinking
Flipped Classroom • Works well with computer-assisted instruction or hybrid course design • Students are responsible for reviewing material prior to class meeting • Class time is reserved for discussion of material and hands-on activities that foster content application	Simulation • Representation of reality where students interact • Example of experiential learning • Promotes critical and evaluative thinking
Team-based learning (TBL) • Based on the premise that cooperative learning is more effective than competition among students • Promotes interpersonal skills • Enhances academic achievement	
Problem-based learning (PBL) • Also known as case-based learning • Implementation varies widely • Consistently produces positive student attitudes • Results in significant improvement in clinical performance • Promotes better study habits • Promotes critical and evaluative thinking	
Simulation • Representation of reality where students interact • Example of experiential learning • Promotes critical and evaluative thinking	

Note. Battersby, 2017; Harris & Bacon, 2019; Johnson et al., 2006; Kolb, 1984; Miller, 2004; Mills-Jones, A., 1999; Prince, 2004

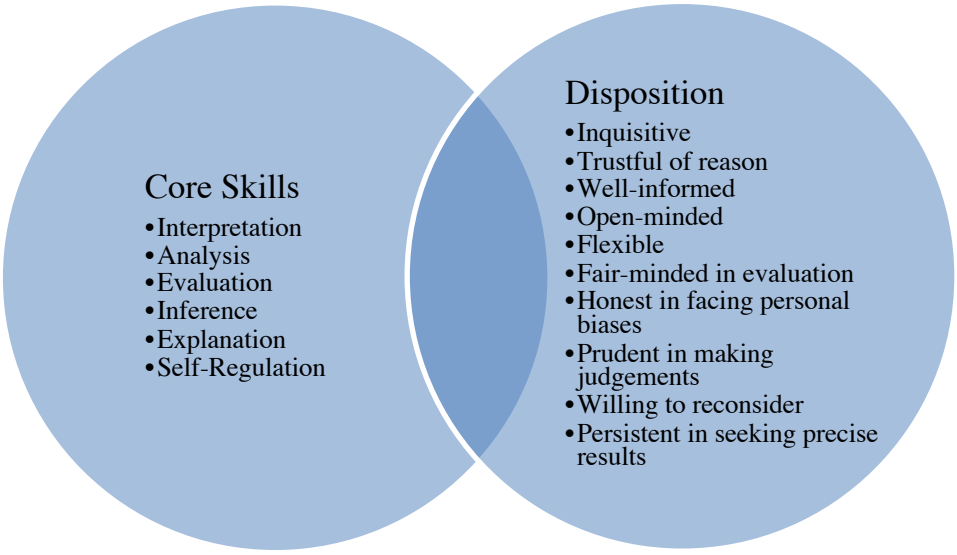
Critical Thinking Development. An integral part of the learning process is critical thinking development, as it is associated with problem solving, clinical decision making and clinical reasoning (Billings & Halstead, 2016). Problem solving focuses on the identification of the problem and resolution, whereas critical thinking combines questioning and critiquing solutions. Finally, clinical reasoning is critical thinking applied to clinical decision making (Billings & Halstead, 2016). The emphasis of dental hygiene program curriculum has shifted to guiding students to become lifelong critical thinkers, therefore dental hygiene educators are accountable for creating and implementing teaching strategies that produce graduates who are able to use critical thinking to determine appropriate clinical judgements (Billings & Halstead, 2016).

In a consensus of experts, the concept of critical thinking is described as involving both affective and cognitive skill domains (Facione, 1990). The ideal critical thinker possesses the ability to combine specific skills with a disposition of purposeful, self-regulatory judgement (see Figure 4) (Facione, 1990). This disposition, or metacognition, is to be fostered alongside the development of critical thinking skills, and ideally modelled by the educator as opposed to being trained to execute.

Three types of knowledge interact in the critical thinking process: declarative knowledge, procedural knowledge, and metacognition, as seen in Figure 5 (Huba & Freed, 2000).

Figure 4

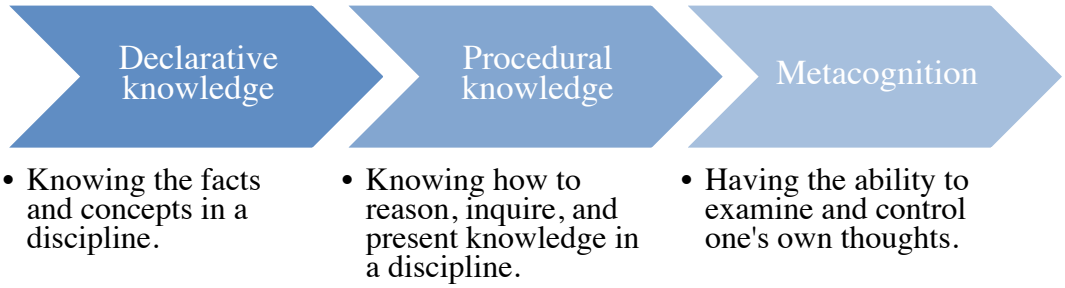
The Ideal Critical Thinker



Note. From Facione, 1990

Figure 5

Essential Components of Critical Thinking



Note. From Huba & Freed, 2000

Declarative knowledge, the facts and concepts in a discipline, is refined in an expert's recall because it is well developed and organized in their memory due to their length of experience in the discipline. Students, not having a foundation of experience, will remember newly introduced information from a standpoint of what they understand and not necessarily what is said (Huba & Freed, 2000). As students' understanding

grows, they will reorganize and modify what they know. To help students reorganize declarative knowledge, it is recommended that activities and assessments should ask learners to present material in a chart, matrix, or outline format.

Once declarative knowledge is attained, students may begin to use that knowledge. Procedural knowledge is based on reasoning strategies, or ways that individuals approach problem solving, specific to the characteristics of the discipline (Huba & Freed, 2000). In dental hygiene, these strategies include, but are not limited to: comparing, classifying, induction, deduction, analyzing perspectives, decision making, investigation, experimental inquiry, and problem solving (Huba & Freed, 2000). Once we have determined how individuals think and reason in our discipline, we are better able to guide our students in the same way. Activities and assessments may be designed with these discipline specific strategies in mind to develop procedural knowledge consistent in our discipline.

Finally, metacognition relies on both declarative and procedural knowledge to solve complex problems. For students to persist through the identification and solving of a problem, a self-monitoring of what they are doing and how they are doing it, and the wherewithal to change reasoning strategies if necessary, is essential. Metacognitive strategies should be taught deliberately, to fully develop critical thinking and problem solving skills (see Figure 6) (Huba & Freed, 2000).

Figure 6

Metacognitive Strategies for Problem Solving

	Planning	Drafting and Trying Out	Monitoring and Revising	Evaluation and Reflection
Procedures	Analysis of a problem Comparison of elements to previously encountered problems Identification of suitable strategies	Series of attempts to apply strategies	Interim adjustments to see if sub-goals are being met Checks to see if strategies are approaching a solution	Looking back to see if the solution was adequate to the problem Self-appraisal of the efficiency and effectiveness of the strategy used

Critical Thinking and Millennial Learners. The level and quality of critical thinking is a primary concern of millennial learners related to the learning process, cognitive development and information seeking (Weiler, 2004). CODA accredited dental hygiene program outcomes seek to develop students who are able to critically think (Commission on Dental Accreditation, 2019), yet students may not share this desired outcome. A study of college students' reasoning for discussing sensitive topics found critical thinking cannot be separated from how they view their information (Trosset, 1998). The study found the main purpose for discussing sensitive topics was for students to convince others of their own viewpoint, and not to gain new information. Findings showed a strong bias in favor of information gained through personal experience, instead of credible sources such as research studies or statistics. Finally, confronting discussion that opposed their opinions or challenged their knowledge was uncomfortable, and therefore should be avoided (Trosset, 1998). This is concerning because it is believed that

the critical thinker must have an attitude or desire to accept the problem that needs to be solved (Billings & Halstead, 2016).

This particular study is not representative of all millennial learners, as this generation has also been described as optimistic, open-minded, flexible, fair, reasonable, and inquisitive (Blue & Henson, 2015; Weiler, 2004). What it may illuminate is that the process of intellectual development takes place over time, where critical thinking is developed until it becomes a regular component of processing information.

Active pedagogy has been established as a means to foster critical thinking, yet competency-based clinical programs tend to favor passive pedagogy in the tradition of upholding measurable, evidence-based assessments (Tedesco-Schneck, 2013). However, active strategies such as problem-based learning and simulation both foster low and high-level cognitive development, and both promote critical and evaluative thinking (Harris & Bacon, 2019). The OSCE is designed to satisfy the need for measurable, evidence-based assessments and may also meet the unique needs of millennial learners.

Objective Structured Clinical Examinations

In 1975, the structured clinical examination was introduced to provide a more objective assessment of medical student's clinical competence when compared to conventional clinical exams (Harden et al., 1975). Traditional clinical exams have several variables, including students, patients, and examiners, whereas structured clinical exams have only two, the standardized patient and the examiner. The elimination of the third variable allows for more control to define what skills, attitudes, problem-solving abilities, and factual knowledge is being assessed (Harden et al., 1975). To participate, the students' progress through a series of timed stations where they are presented with a

problem to solve or a procedure to complete, with each experience building upon the last (Harden et al., 1975). The implementation of the OSCE is efficient, in that more than one student can participate at a time depending upon the number of stations.

OSCEs prove to be a valid and reliable assessment of clinical competency in addition to being a more ethical option than a single encounter, live patient based examination (ADEA, 2018; Sabzi et al., 2018). For this reason, OSCEs are utilized to assess clinical competence in multiple disciplines in countries across the globe (Jindal & Khurana, 2016), including optometry, orthopedics, obstetrics and gynecology, anesthesiology, pediatrics, nursing, dentistry, pharmacology, and psychiatry to name a few.

The value of OSCEs are not only as an assessment tool in experiential and PBL, (Brazeau et al., 2002; Zahid et al., 2016), but also as an effective teaching tool (Chisnall et al., 2015; Lara et al., 2020; Yorke, 2003). A formative OSCE is an example of simulation, where instructors observe and provide feedback related to students' skill (Chisnall et al., 2015). In clinical education settings, formative OSCEs may become summative as students apply instructor feedback and are able to demonstrate mastery. Also referred to as a teaching OSCE, the formative version can also familiarize students with separate summative OSCEs which are used for professional licensure (Brazeau et al., 2002).

Student and Faculty Perceptions

Multiple research studies have focused on both student and faculty opinions of OSCEs within a variety of healthcare disciplines. A qualitative study exploring the undergraduate and postgraduate healthcare student's experience of an OSCE found three

common themes: anxiety about the OSCE, preparation was seen as a coping strategy, and simulation was a further cause of anxiety (Fidment, 2012). Recommendations for better preparation of students included appropriate support, effective planning, and simulation should be grounded in practice. Overall, the study concluded that students valued the OSCE as a worthwhile assessment (Fidment, 2012).

A literature review of dental undergraduate student perceptions of OSCEs had similar findings as Fidment (2012), stating that OSCEs can induce high levels of anxiety when compared to other forms of assessment (Puryer, 2016). Despite high anxiety, this had not affected student performance, and the majority would choose to have a similar form of assessment again; a strong indicator of support for OSCEs (Puryer, 2016).

A cross-sectional analytical observational study of dental students' perceptions related to OSCEs found almost half of the participants agreed that the OSCE was fair, and that a range of clinical skills were included in the OSCE. A high percentage of students viewed the experience as very stressful. Similar findings were recorded by Fidment (2012) and Puryer (2016). The overall conclusion was the OSCE is a meaningful and fair assessment for clinical skills (Nazzawi, 2018). In alignment with Fidment's (2012) recommendation, Nazzawi recommends an emphasis on preparing students and staff before the OSCE and to ensure clear instructions are provided (2018).

Of particular interest due to the population sample is an exploratory study analyzing clinical faculty perceptions on assessment methods used to evaluate the clinical competency of dental hygiene students (Perry et al., 2015). Results revealed the OSCE was perceived as most effective (83%) in assessing clinical competency, followed by daily clinical grading (63%). Formative assessment in combination with summative

assessment rated the highest (44%) in thematic analysis of qualitative data, and summative assessment alone was the least perceived effective form of assessment (16%) (Perry et al., 2015). Results demonstrated that participants were satisfied with current assessment strategies, but reported a variety of methods are needed to evaluate competency.

Common themes related to student and faculty perceptions of the OSCE within these articles reveal that the OSCE is viewed as a fair assessment for clinical skills yet can produce high anxiety for students. Even with this negative outcome, there is strong support for the OSCE. The overall recommendation is to emphasize student and staff preparation to reduce anxiety.

Virtual OSCEs. The public health crisis caused by the novel coronavirus of 2019 forced a paradigm shift in the delivery of healthcare educational programs, including dental hygiene. Use of technology in education is no longer an educator's choice in teaching methodology, but a requirement as campus suspensions forced learning into online platforms. For clinical programs, such as dental hygiene, a lack of clinic access halts psychomotor skill development. Educators were forced to innovate methods of teaching, learning, and assessment by modifying existing traditional methods, leading to the development of the virtual OSCE for clinical education settings (Ali, 2020; Boursicot et al., 2020; Lara et al., 2020; Major et al., 2020).

Virtual OSCEs (vOSCEs), or teleOSCEs utilize advanced technology such as teleconferencing software and learning management systems for conducting formative and summative assessment of students' learning. Just as in face to face settings, vOSCEs

are designed to have students complete a task or assessment while advancing through a series of proctored stations which are timed (Beebe et al., 2014; Harden et al., 1975).

Several studies have been published in the short amount of time since being required to provide learning and assessments remotely. All studies found at this point in time state that vOSCE development was a necessary means to uphold their profession's standards, but also recognized that the development of virtual or semi-virtual assessment methods for OSCE was uncharted.

A new era of OSCE is described in Ali's case study for pharmacology assessments (2020). The educational description included the use of free online simulation software and teleconferencing programs such as Zoom with breakout rooms for asynchronous OSCEs. Educators had already been creating and delivering real-life case scenarios in their courses which made the transition of these case scenarios to online familiar for students. The majority of students agreed that they learned more from the virtual OSCE than they would have in the face to face OSCE because of the instant feedback they received after completing their tasks. This reinforces the vOSCE's formative assessment value. However, although it was valuable as a formative assessment, participating students indicated they did not appreciate the lack of interaction with patients or healthcare professionals, and also thought they received less points in the vOSCE than they would have in a face to face OSCE. Despite the student reservations, Ali notes this was an extraordinary learning experience for their institution during an unprecedented time and that much can be done to refine this OSCE method (2020). Recommendations for future research include standardizing a framework for alternative

OSCE methods to include virtual or online, to better prepare students for telemedicine (Ali, 2020).

In Major and fellow researchers' pilot vOSCE (2020), clinical skills were assessed for obstetrics and gynecology students in Qatar. Their Clinical Skills and Simulation Lab created a vOSCE to determine its feasibility and to evaluate stakeholder's experience. The vOSCE created was for women's reproductive and sexual health and utilized Zoom to conduct assessments, along with email and WhatsApp for backup communication. All essential activities were able to be conducted virtually as in person, with the exception of physical exam skills. Essential activities included accurate history taking, communication and rapport building, critical reasoning, and providing physical exam findings. Major and colleagues describe steps taken to prepare for the pilot, including testing the pilot which doubled as a training for faculty and simulated patients. All involved agreed that expectations were clear and that it was an overall positive learning experience fostering a safe and valuable learning activity. Recommendations were to allow more time for simulated patient portrayals in Zoom. Like Ali's (2020) research, Major and colleague's (2020) pilot identified a need to teach telemedicine.

Another study adapted a summative pediatric OSCE to be provided virtually (Lara et al., 2020). Zoom teleconferencing software in addition to local standardized patient checklists, communication scoring tools, and faculty observation rubrics were utilized. The summative OSCE was test run with non-clerkship student volunteers to ensure feasibility. A description of the vOSCE is provided that although unique in content to this particular educational institutional program, was similar to every other vOSCE described so far where students advance through timed sessions that build upon

one another. Their findings were that the vOSCE is statistically comparable to live OSCE as an assessment, and is feasible for both undergraduate and graduate medical education programs. Additionally, remote assessments will save on travel time and costs. Once again, the vOSCE is described as a way to accommodate telemedicine assessments, which are quickly becoming essential in medical education (Lara et al., 2020).

Bouriscot et al. (2020) publication described how they adapted OSCEs to a hybrid platform of mixed physical outpatient clinics and Zoom, as a means to provide guidance to other medical schools navigating the public health crisis with a focus on ensuring validity and reliability of a high-stakes performance assessment. There were no changes made to the content, station design, or standard setting procedures. Due to patient recruitment difficulty, they did replace some with simulated patients and adjusted scoring rubrics accordingly. OSCE stations were held in physical locations with special arrangements for social distancing and infection control put in place. Zoom on iPads was used primarily for examiner briefing, calibration, and scoring. Overall findings were that measures adopted affirmed the defensibility of the OSCE results. It was noted that adapting the OSCE to be held virtually required the collective support of all involved, including the healthcare sector, academic and administrative staff, students, examiners, simulated patients and client patients.

Emerging themes from these early published articles demonstrate that virtual OSCEs are able to assess all aspects of essential activities that OSCEs assess with the exception of physical skills, and that a vOSCE is a viable formative assessment. Each researcher described the methods used to implement a virtual OSCE, with all except one, using Zoom online conferencing with timed breakout sessions, a simulation, and

standardized checklists or rubric for instructor evaluation. With little being studied about vOSCEs, there is a paucity of evidence related to student and faculty perceptions. Even though early evidence shows an acceptance of vOSCEs as a viable formative assessment tool, we can look to the well-researched OSCE as a way to foreshadow.

Summary

The short, multimedia format of vOSCEs coincides with the educational preferences of millennials; to learn by doing, and having structured learning units with immediate feedback (Beebe et al., 2014). The recent adoption of virtual teaching through simulation may have seemed like a necessary evil for some baby boomer or Generation X educators, but for millennial students, the vOSCE is a disruptive innovation resulting in better engagement of study habits, increased learning due to the low risk nature, the promotion of critical and evaluative thinking, and being able to better identify gaps in student knowledge (Harris & Bacon, 2019; Pugh et al., 2018; Tedesco-Schneck, 2013; Weiler, 2004).

Methodology

Research Method or Design

Like many clinical educators during the early weeks of the public health crisis caused by COVID-19, the principal investigator (PI) developed, implemented, and evaluated the vOSCE described in the Steps to Implementation section. Seeing the value not only for process evaluation of educational models which was originally intended, but for phenomenological analysis, this retrospective study was proposed. The phenomena of continuing education during a pandemic provided the opportunity to evaluate a disruptive innovation in teaching and learning.

Because the PI was the vOSCE developer to which this research was based upon, bracketing was used to mitigate potential negative effects of unacknowledged preconceptions related to the research (Creswell, 2007; Tufford & Newman, 2012). Bracketing has the potential to greatly enrich data interpretation only to the extent that the researcher maintains self-awareness throughout the process. The method of bracketing used in this study was writing notes as a means of reflecting and examining the researcher's engagement with the data (Tufford & Newman, 2012).

Preconceptions of the researcher in the area of virtual teaching and learning are based upon the experience of having been a fully online undergraduate and graduate student and also teaching adults in online platforms. The researcher has a natural preference for a progressive adult learning philosophy where her style is learner-centered. The learning environment she strives to create encourages active inquiry and problem-focused collaboration that simulates real-life experiences. Special interests include

utilizing technology in teaching and fostering student engagement and agency. Throughout the data analysis, interpretation, presentation of the study's results, and discussion sections, any related personal values, beliefs, thoughts, biases, emotions, and assumptions about the lived experiences related to the phenomenon was acknowledged and critically evaluated for contribution to the understanding of the phenomena.

The design of this study was a retrospective phenomenological cohort study analysis, as the vOSCE had already been implemented. Research methodology for this proposed study was from a qualitative perspective. To minimize validity threats common to qualitative research, strategies for rigor include respondent validation and methodological triangulation. Bracketing of the PI's preconceptions related to the research was also acknowledged. This approach allows for descriptive and interpretive methods in studying the social aspects and context of student and instructor experiences with vOSCEs.

The research question answers what implications there may be for future formative vOSCE use in dental hygiene programs. This question was answered by the following related questions: Would an orientation to introduce and describe successful OSCE implementation and participation be effective? What aspects of the vOSCE worked well and what did not? What would participants like done differently? Would participants recommend the continuation of vOSCEs for future dental hygiene students? By looking at dental hygiene student and clinic faculty experiences within this phenomena, this research will contribute to the gap in knowledge related to dental hygiene student and faculty perceptions of formative vOSCEs.

Procedures

Participants were presented with an orientation prior to participating in the vOSCE to complete instrumentation competencies for quarterly clinic requirements (see Appendices A and B). Four competencies were completed for each student, the periodontal probe, universal curet, and two area specific curets. A clinical instructor was assigned to each instrument competency and the students advanced through each competency consecutively following a specific schedule (see Appendix C). Immediately following the vOSCEs, students completed an anonymous survey for process evaluation while faculty attended a debriefing to share feedback (see Appendices D and E).

Human Subjects Protection/Informed Consent

The intent of the student surveys and faculty feedback sessions were for process evaluation. Informed consent was not requested due to the original nature of the assessment. Issues of respondent confidentiality have been protected by not disclosing demographic information, including the name of the educational institution or year of study student respondents were in at the time of the vOSCE implementation. This project was classified as a Quality Assurance project to be recorded with the Institutional Research Office. A Letter of Support was provided by the hosting institution (see Appendix F).

Sample source, plan, sample size, description of setting

A purposive sampling of informants was conducted which included 30 undergraduate students over the age of 18 who were enrolled in a dental hygiene baccalaureate program and four clinical faculty. Inclusion criteria can be found in Appendix G. Due to the ex post facto nature of this study, there was no exclusion criteria

as every member of the student cohort participated. Participating faculty were either working within their contract or volunteered out of their own curiosity to the experience.

The vOSCEs for specific quarterly requirements were implemented within a dental hygiene program. The dental hygiene student cohort utilizes Canvas learning management system and have incorporated Zoom online conferencing as a platform for remote learning during campus suspensions. The college is accredited at the associates and bachelor's degree level and the dental hygiene program is accredited by CODA.

Variables

This phenomenological study sought to describe the meaning of the shared experience of vOSCEs for dental hygiene students and faculty. The purpose of this approach was to develop a description of the essence of the experience for all involved (Creswell, 2007). Variables were determined by open-ended coding of student surveys and faculty interviews, and then organized into themes.

Instruments

Tools used to collect data were a survey of student informants using an ungraded, anonymous design within Canvas learning management system and post implementation small group interviews with faculty informants (Appendices D and E).

Equipment

Equipment required to implement and for all to participate in vOSCEs included a reliable internet connection, a desktop or laptop computer with webcam and internal microphone, and access to Zoom Internet conferencing software. Clinical equipment included a dentoform, desk mount, UNC probe, universal curet, Gracey 11/12, and Gracey 13/14 instruments.

Steps to Implementation

Continuing education related to clinical simulation and use of technology in education was sought. A Virtual Clinical Assessment webinar hosted by the American Dental Education Association (ADEA) Just in Time Series and presented by Brandy Cowen, RDH, EPDH, MS (Cowen, 2020) was attended by the PI. With access granted to Cowen's virtual clinical assessment sample materials (see Appendix K), the following steps were taken to adapt and implement a vOSCE for dental hygiene student instrumentation competencies. Instructional design for the virtual instrumentation competencies followed the ADDIE product development paradigm.

The ADDIE Approach. ADDIE is an acronym for *Analyze, Design, Develop, Implement,* and *Evaluate*. This concept was chosen for its ability to facilitate the difficulties of a complex and intentional learning environment (Branch, 2009). ADDIE is effective in addressing performance discrepancies when instruction has been deemed appropriate for gaps in knowledge or skill (Branch, 2009). Application of the ADDIE paradigm to the instructional design for virtual instrumentation competencies can be seen in Figure 7.

Figure 7

Instructional Design for Virtual Instrumentation Competencies

	Analyze	Design	Develop	Implement	Evaluate
Procedures	**Validate performance gap**: Clinic closure indefinitely due to public health crisis leaving students without access to live patient experiences and no way to continue their clinical education. **Instructional goals:** Identify essential resources and platforms to facilitate virtual clinical assessments. Synthesize a virtual objective structured clinical examination. Apply methods for assessment of virtual instrumentation competencies. Evaluate the value of vOSCEs in virtual clinical assessments. **Intended audience:** Dental hygiene students and clinic faculty. **Delivery system:** Synchronous online	**Task inventory was completed.** **Performance objectives:** Understand the purpose of OSCEs Identify quarterly competencies to be assessed virtually Utilize the virtual instrumentation schedule to access competency assessment Demonstrate proper dentoform and webcam positions for successful evaluation **Testing strategies:** Using Clinic Process Evaluation forms, students will demonstrate competency of the UNC Probe, Universal Curet, Gracey 11/12, and Gracey 13/14 via online conferencing software. **Return on Investment:** Students will have an alternative means to demonstrate clinical skill Faculty will have an alternative to assess clinical skills Both students and faculty will maintain a means for continuing education	**Generate content:** Virtual Instrumentation Competency student schedule **Develop supportive media:** Video demonstration of Zoom for faculty calibration **Develop guidance for the student:** Virtual Instrumentation Competency Orientation PowerPoint and formative OSCE **Develop guidance for the teacher:** Virtual Instrumentation Competency calibration resources and meeting agenda **Pilot test and formative revisions:** Formative OSCE was provided for faculty during calibration	**Prepare the teacher:** A calibration was provided to six faculty members, four of which were to participate in actual OSCE A formative OSCE was conducted to allow faculty an opportunity to test Zoom links and zoom features and review competency process. **Prepare the student:** A two hour Virtual Instrumentation Competency Orientation was provided to 30 students and 6 faculty. Formative assessment via breakout sessions with faculty allowed students an opportunity for one on one faculty guidance on dentoform and webcam proximity.	**Student Evaluation criteria:** Modified Clinic Process Evaluation forms Instrumentation Competency Student Survey **Student Evaluation tools:** Observation Simulation Performance checklist Survey **Faculty Evaluation criteria:** Instrumentation Competency Faculty Feedback Questions **Faculty Evaluation tools:** Interviews **Conduct evaluations:** Formative Faculty Student Summative Faculty Student

Note. From Branch, 2009

Analyze. With several weeks remaining of Winter quarter, campuses closed due to the public health crisis caused by COVID-19. Lack of clinic and classroom resources prevented students from meeting certain course objectives and hindered further development of psychomotor skills. Having identified the performance gap, a purpose statement for the instruction was created. The purpose of the vOSCE was to provide an effective platform for clinical instruction and assess improvement in students' critical thinking and psychomotor skills. The following instructional goals were created to respond to the performance gap caused by the lack of resources and skill:

1. Identify essential resources and platforms to facilitate virtual clinical assessments.
2. Synthesize a vOSCE.
3. Apply methods for assessment of virtual instrumentation competencies.
4. Evaluate the value of OSCEs in virtual clinical assessments.

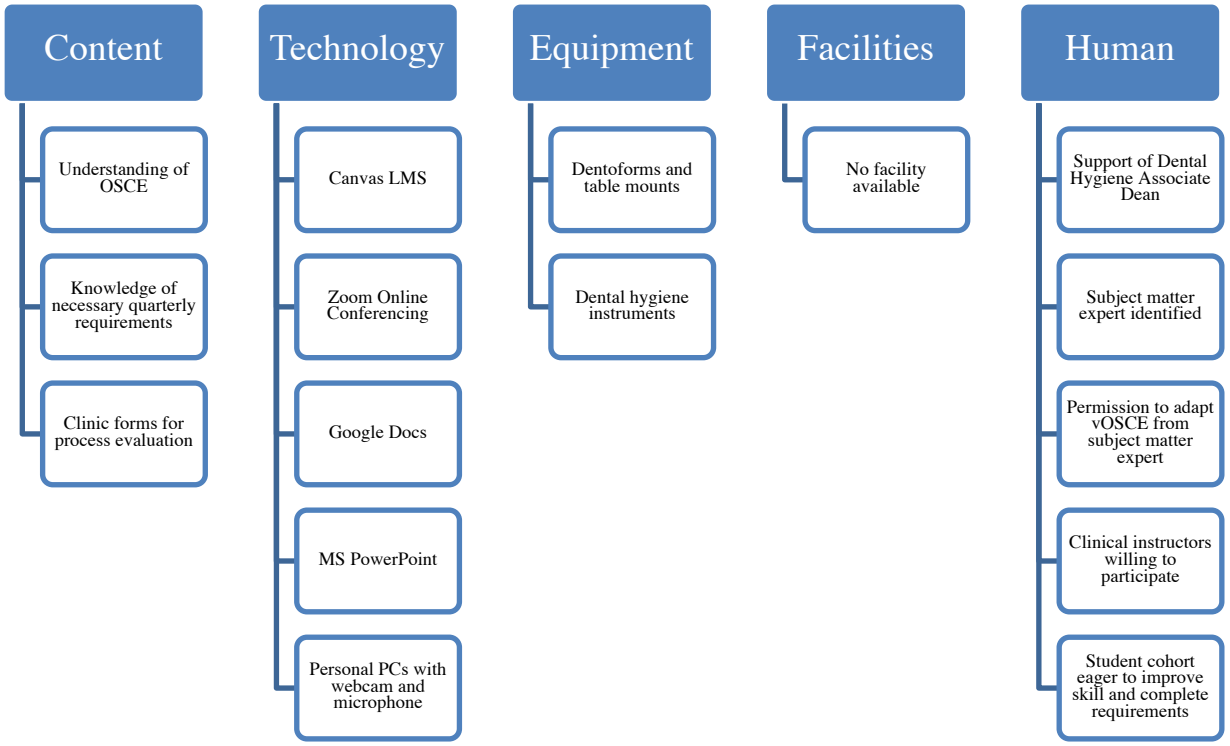
The intended learners were a group of 30 dental hygiene students within an accredited dental hygiene program. Due to the retrospective design of this research, informed consent was not received to be able to describe in detail general characteristics including age, gender, level of education, cultural diversity, or language, which was a component of the Analyze section. However, it is common knowledge the majority of today's college students are between the ages of 18 and 41, the age span of the millennial generation.

Content, technology, instructional, and human resources were identified and are shown in Figure 8. With face-to-face meetings not possible, the delivery system deemed most appropriate was live, synchronous Internet-based video sessions utilizing Zoom online conferencing. The project management plan consisted of identifying core

instructional team members, identifying constraints related to internet technology, and scheduling tasks for a successful completion.

Figure 8

Resource Audit for vOSCE



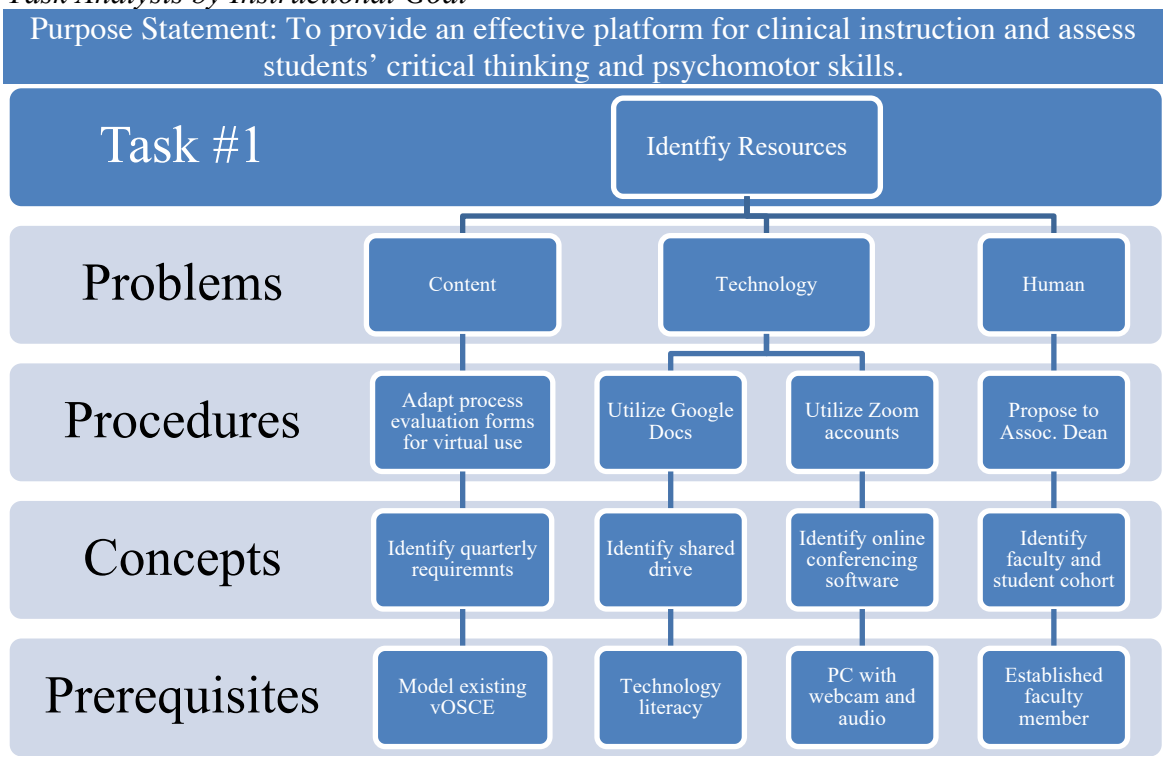
Design. As seen in Figure 9, a task inventory was conducted for each instructional goal.

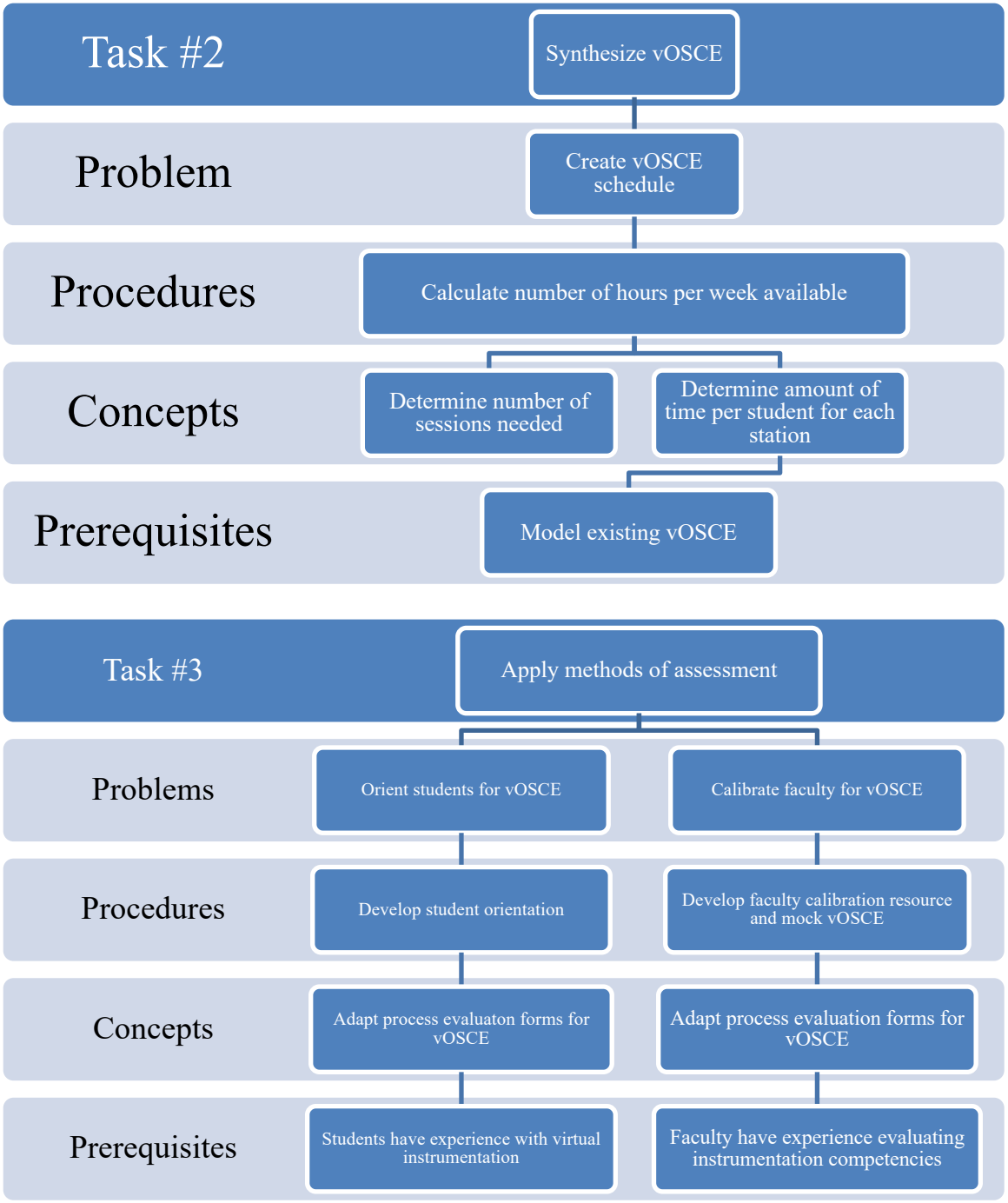
Identify Resources. The first step was to identify essential resources and platforms to facilitate virtual clinical assessments. An understanding of virtual clinic assessments from Cowen (2020) was necessary in order to adapt the process for content resources. The UNC Probe, Universal Curet, Gracey 11/12 and Gracey 13/14 quarterly requirements for instrumentation competencies were chosen, as students had been

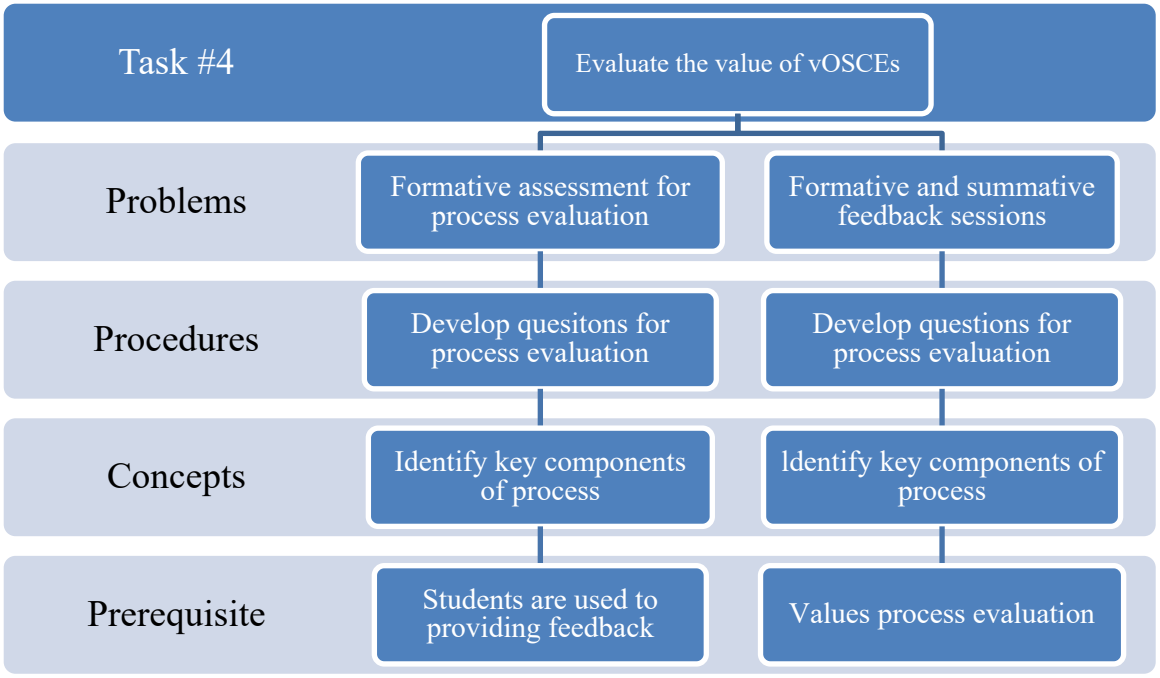
recording instrumentation practice sessions as assignments with these specific instruments for weeks prior. Technology resources were already in place due to the recent requirement for remote learning. Faculty share a Google Drive for collaborative documents and a license for Zoom was provided for all faculty use. Zoom was the chosen platform for implementing vOSCEs, as students and faculty were familiar with creating, accessing, and navigating Zoom meetings. Human resources for implementation included the PI, who was also a Lead faculty member, and volunteer clinic faculty for implementation. The preliminary vOSCE plan was proposed to the Associate Dean of Dental Programs and was approved.

Figure 9

Task Analysis by Instructional Goal







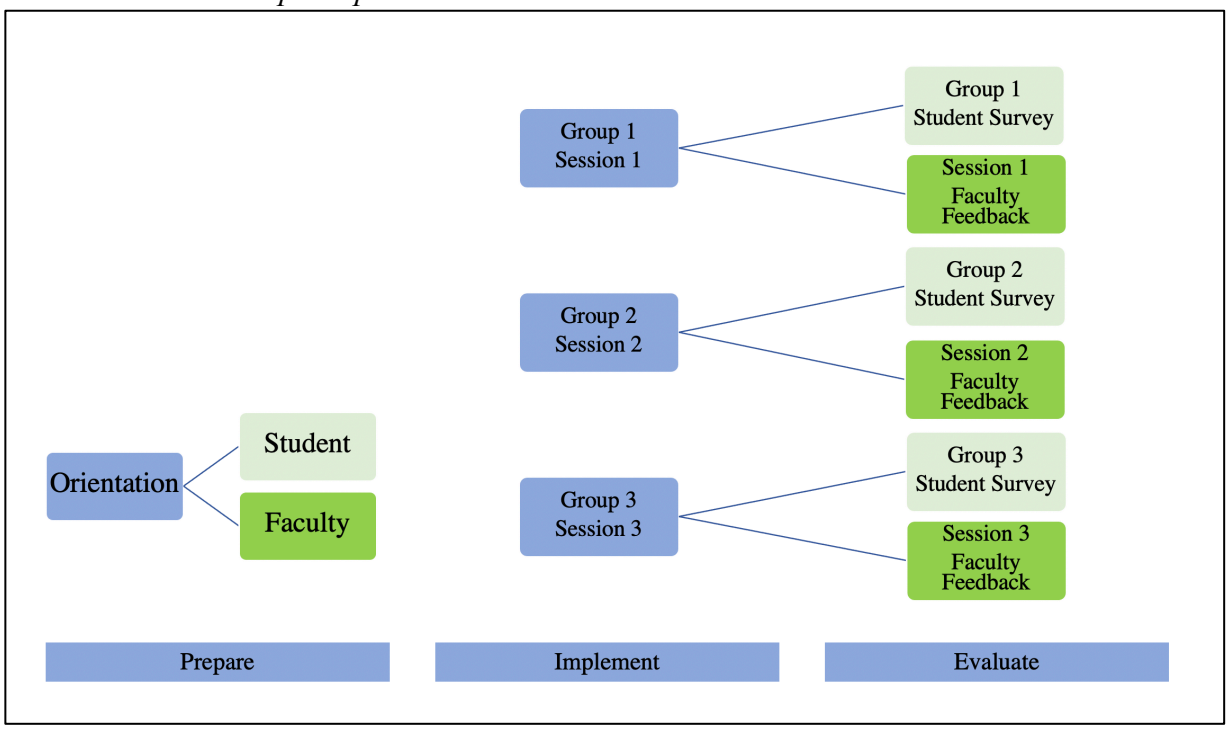
Synthesize vOSCE. Next, it was necessary to synthesize a vOSCE. The vOSCEs were implemented in a Dental Hygiene Theory and Practice course which allowed two hours of class time per week. The number of instrument competencies determined the number of clinic faculty needed for observation of the competencies, therefore four clinic faculty were confirmed, and one was assigned to each instrumentation competency. In addition to the four clinic faculty, the PI acted as a manager to support and facilitate a smooth process. Each faculty member was asked to create a unique Zoom online conferencing link, which was added to the Virtual Instrumentation Competency Schedule (see Appendix C).

Ten minutes per competency station had been determined as sufficient (Cowen, 2020), and a 10 minute break after every 50 minutes was included in the schedule. For thirty students to complete four competencies requiring ten minutes, the vOSCEs were held once a week over three weeks for a total of five and a half hours. The last 30 minutes of the last session was held for students who needed a second attempt with remediation.

This allowed for a maximum of twelve students to perform second attempts. Finally, student names were entered into the schedule with each student advancing through each instructor's Zoom link in ten-minute consecutive sessions. Once the schedule was complete, it was provided to the students and faculty via Google doc for the most up to date version possible.

Figure 10

OSCE Process Concept Map



Methods of Assessment. With resources identified and the vOSCE developed, the next step was to apply methods for assessment of virtual instrumentation competencies. Existing clinic forms for instrumentation process evaluation required revision due to the virtual nature of the OSCE (see Appendix H). Instructor observation and utilization of these adapted forms as rubrics were to be the main method of assessment. Specific evaluation criteria such as preparation, infection control, lighting, student position, and mirror were removed due to students not being in a face to face learning environment.

An orientation for students and attended by faculty was conducted; a separate faculty calibration followed (Appendices B and A, respectively). The student orientation consisted of a presentation on vOSCEs, which instrument competencies would be involved, sharing the Student Schedule and demonstrating how it was read. The students were made aware that during the vOSCE, if anything were to go wrong and they weren't sure what to do, they could access the lead instructor's Zoom link at any time for direction, as the Lead would not be observing vOSCEs. Alternatively, Canvas email would be monitored if they weren't able to use Zoom. A full list of required supplies was reviewed, much of which they already had with them at home. Supplies included: an electronic device with a webcam and microphone, their periodontal or restorative dentoform, a table mount or tripod, and all four instruments for competency assessments. Instrumentation sequence was reviewed for each competency. Access to instrumentation process evaluation forms was provided.

On the day and times of their scheduled sessions, the students were to access their vOSCE by clicking on their assigned Zoom link. They would enter a waiting room until it was their exact assessment time, at which point the instructor would admit them into the main room. Assurance was made that this time would not be interrupted by other incoming students for their privacy. Once ready, the student began their instrumentation with their appropriate instrument and sequence. A special emphasis was made for students to use their understanding of the clinic process evaluation form to demonstrate their instrumentation skill. Students audibly described the instrumentation process as they performed the skill. This was to demonstrate their critical thinking yet acted as an assurance for the instructor that the student was using proper technique in the event the

webcam's view of the instrument was obstructed momentarily by the student's hand or dentoform position.

For the second half of the orientation, students were divided into five breakout sessions with one clinic faculty member to perform a formative vOSCE. Chisnall et al. (2015) distinguishes between a mock OSCE and a formative OSCE, stating that a mock OSCE replicates the summative OSCE in all aspects including timing, format, layout, length, and station content. The student orientation did not replicate the actual vOSCEs, but provided the faculty an opportunity to identify struggling students for additional support prior to the summative vOSCEs (Chisnall et al., 2015). One at a time, students practiced setting up their dentoform to the webcam for ideal lighting, viewing, and demonstration purposes. Faculty would 'pin' each student's video frame to simulate a one on one session. The students who were observing had an opportunity for peer learning, as they applied the instructor's advice for their peer to their own camera and dentoform setting.

With vOSCEs being implemented for the first time within this dental hygiene program, a special emphasis on faculty calibration was made. A Zoom tutorial video was recorded and provided to all faculty involved. This video demonstrated how to schedule a Zoom meeting and how to select account settings most appropriate for the vOSCE (see Appendix I). Faculty were asked to create their unique Zoom links and send them to the Lead for inclusion in the calibration meeting agenda. The Zoom links were then put into a formative vOSCE for faculty to attempt during the meeting.

Dates and times of the scheduled vOSCE were confirmed and the Student Schedule was provided, which was recommended to be printed and available during the

session. During the sessions, the lead would begin a cell phone text thread with all faculty as a means for communication. If faculty had any technology issues, student issues, or schedule issues, the lead would troubleshoot. Virtual clinic competency forms were reviewed. In a face to face environment, students keep paper copies of their forms in their Performance Notebooks. For the vOSCE, faculty saved electronic versions of the modified form by using the students first name and last initial with the instrument name following. They then uploaded the form into Dental Hygiene Theory and Practice course in Canvas, under the files tab and in the virtual instrumentation competency folder. A complete overview was then discussed of the actual vOSCE.

Faculty were to enter their Zoom links prior to the first scheduled student's time. At the scheduled time, the faculty member would admit the student from the waiting area. It was recommended that a 10 minute timer be set on the faculty's cell phone as a reminder of the time. Just before the competency, student and faculty would ensure that the dentoform and lighting were optimal for evaluation. Faculty would remind students to use the proper instrument sequencing and to verbalize their instrumentation. After the competency, students were shown their evaluated clinic form and notified of their score. Areas for main improvement should be discussed, and remediation may take place if time allowed. A specific date and time for remediation during the last vOSCE session would be available if needed.

Faculty were asked to keep track of student names who needed a second attempt after remediation and also students who did not attend their session. Faculty were invited to stay in the main Zoom meeting to provide feedback on student and faculty orientation following the formative vOSCE. With the meeting agenda completed, faculty were

provided with a process evaluation schedule. Assigned faculty left the main Zoom meeting and entered into their own Zoom links that were created for the student vOSCEs. The remaining faculty entered and exited each Zoom meeting, which provided an opportunity to practice admitting 'students' into their exams.

Evaluate the Value of vOSCEs. The last instructional goal was to evaluate the value of vOSCEs in virtual clinical assessments. For the purpose of process evaluation and continual improvement of learning and teaching strategies, an anonymous, ungraded survey was sent to participating students after each vOSCE session. For the same purposes, voluntary faculty feedback sessions were held after the calibration meeting and after each vOSCE session.

Performance objectives for student orientation and virtual instrumentation competencies were the following:

1. Understand the purpose of an OSCE
2. Identify which quarterly competencies will be assessed virtually
3. Utilize the Virtual Instrumentation Schedule to access your competency assessment
4. Demonstrate proper dentoform and webcam positions for successful evaluation

Testing strategies included the formative vOSCE and summative vOSCE. Strategies described in the task analysis were designed to evaluate if the student demonstrated the required performance under specific conditions to specific criteria for performance. Due to the retrospective aspect of this study, a return on investment was not completed prior to implementation. However, the non-monetary benefit of this training program would arguably be that students would have an alternative means to demonstrate clinical skill,

faculty would have an alternative to assess clinical skills, and both students and faculty would have a means for continuing education.

Develop. The student orientation and faculty calibration as described in the Design section's task analysis served as instructional content. A lesson plan for the student orientation can be found in Appendix J. The plan's beginning activities include information that clarifies objectives and confirms prerequisites, as students had been practicing instrumentation techniques up to the date of the vOSCEs. Middle activities included presentation, discussion, and demonstration by simulation. End activities included guided practice with feedback, peer teaching, and independent practice. Existing instructional media included Google Docs and Zoom online conferencing software. Visual media was developed for the student orientation and faculty calibration using MS PowerPoint and Word. Auditory media included synchronous discussion and peer discussion. Kinesthetic media included student demonstration of instrumentation on dentoforms during formative vOSCEs. Guidance for students and faculty was provided with an agenda itemizing the flow of the orientation or calibration, with an outline of times spent on each agenda item. The formative vOSCEs for both students and faculty were field trials, or pilot tests, for formative revisions. Student and faculty performance was adequate to move to the implementation of the summative vOSCEs. The success of student and faculty participation in the pilot test was indicative that the delivery system planned for the instruction strategies were feasible (Branch, 2009).

Implement. The implementation strategy included both a student plan and faculty plan, which were itemized in detail as the Student Orientation and Faculty Calibration within the Design section's task analysis.

Evaluate. The ADDIE approach to instructional design typically promotes three levels of evaluation: perception, learning, and performance, with each level preceding the other (Branch, 2009). Level 1, *perception*, measures items that students tend to associate with a good course. This evaluation was administered by the instructor to measure student perceptions immediately at the conclusion of the course within the learning environment. The purpose was to gauge the degree of satisfaction with the course and with the teachers. Level 2, *learning*, measures knowledge and skill acquisition and was also administered by the instructor, yet can be anytime during the course of instruction prior to beginning a new set of skills or knowledge set. The purpose of this evaluation was to determine student potential to perform and to also determine the quality of the learning resources. Level 3, *performance*, measures actual learning transfer. Instead of the instructor, a supervisor or neutral person conducts this evaluation immediately after the student has completed the task and until a date that represents a complete task cycle. The purpose of this level of evaluation is to determine a student's ability to perform a task and also to judge whether the performance gap has been closed (Branch, 2009).

The vOSCE learning unit included a level 1 and level 2 evaluation. The criteria for student evaluation can be found in the Modified Clinic Process Evaluation Forms (see Appendix H) and in the Instrumentation Competency Student Survey (see Appendix D). Evaluation tools were observation, simulation, a performance checklist, and finally an anonymous, ungraded survey held within Canvas LMS. Faculty evaluation criteria can be found in Instrumentation Competency Faculty Feedback Questions (see Appendix E). Evaluation tools included ongoing interviews before, during, and after vOSCe sessions.

Statistical Analysis

A phenomenological approach of analysis relies on induction to generate new descriptions and conceptualizations of an event or experience. The recommended strategy for analysis was the hermeneutic circle or cycle. (LoBiondo-Wood & Haber, 2014; SAGE Research Methods, 2020; Vogt & Johnson, 2016). For both student surveys and faculty interviews, horizontalization was used to interpret significant statements that would provide an understanding of how the respondents experienced the phenomena of vOSCEs (Creswell, 2007). Respondent surveys and feedback data was read multiple times to obtain an overall sense of meaning. Significant statements or phrases from the two data sets were identified and sorted into codes. The codes were then organized into common themes based on patterns that arose. A structural description has been provided in the Steps to Implementation section. A textural description of the shared experience was written to present an essence of the phenomena (Creswell, 2007).

To address validity and reliability of the study, respondent validation was conducted and triangulation, or combining methods of data collection and analysis was applied. Philosophical presuppositions of the PI related to vOSCEs were identified through bracketing, which was applied as much as possible in order to evaluate and describe the phenomena from a perspective of someone never having had experience with vOSCEs before (Creswell, 2007).

Summary

The phenomena of continuing clinical education during a pandemic provides the opportunity to evaluate a disruptive innovation in teaching and learning, the vOSCE. Student and faculty perceptions may determine if there are implications for future use of formative vOSCEs within dental hygiene program curriculum. The design of this study was a retrospective phenomenological cohort study analysis. Research methodology was from a qualitative perspective. To minimize validity threats common to qualitative research, strategies for rigor include respondent validation and methodological triangulation. Bracketing of the PI's preconceptions related to the research was also acknowledged. This approach allows for a textural and structural description of shared experience to present an essence of the phenomena. The proposed methodology for this research was comparable to other retrospective phenomenological study designs and statistical analysis was appropriate for qualitative research.

Results

Description of Sample

The vOSCE included 30 dental hygiene students (*N*=30), four clinical faculty (*N*=4), and one faculty member, the PI, who acted as manager. A total of 30 students and four faculty participated in the virtual instrumentation competencies via vOSCE. Out of 30 students, 24 completed the ungraded, anonymous survey post-vOSCE, and all four faculty participated and contributed to feedback sessions following each vOSCE (*n*=4), as seen in Table 1 (*n*=24).

Table 1

Description of the Sample

Sample	Number of vOSCE Participants		Number of post-vOSCE Respondents	
	n	%	*n*	%
Students	30	100	24	80
Faculty	4	100	4	100

Note. *N*=34 (*n*=28).

Statistical Analysis

The results of this study answered the research question of what implications there may be for future formative vOSCE use in dental hygiene programs. By asking respondents process evaluation questions related to the vOSCE orientation and implementation, future actions related to vOSCE use in dental hygiene programs can be made. Interpreting the following data also provides a textural description, or answers the question of how the vOSCE was experienced (Creswell, 2007).

Student Respondents

From 24 student survey responses (*N*=24), 21 reported feeling prepared enough to participate in the virtual instrumentation competencies held via Zoom. One student who did not feel prepared recommended to practice instrumentation more beforehand, and the other two recommended practicing on their dentoform the way the virtual instrumentation competency was designed rather than having their dentoform on a table mount as they had all quarter previously. When asked if students would recommend continuing the virtual competency format with future students, 20 respondents said yes, while four of the 24 students were undecided (see Table 2).

Table 2

Student Responses to Preparedness and Future Recommendations

Process Evaluation Questions	Yes		No		Undecided	
	n	%	*n*	%	*n*	%
Did you feel prepared enough to participate in the virtual instrumentation competencies held via Zoom?	21	87.5	3	12.5	0	0
Would you recommend us to continue this virtual competency format with future students?	20	83.3	0	0	4	16.6

Note. This table describes the number and percentage of student respondents for two process evaluation questions.

The PI, who was also the vOSCE designer, purposefully implemented the instrumentation competencies after students had been practicing on dentoforms for seven weeks in order to provide them the opportunity to practice the simulated experience prior to the vOSCEs. Students submitted weekly recorded instrumentation practice sessions with their dentoforms on mounting tri-pods or desk mounts. To record their practice

session, the recording device was placed in an area of convenience, often from a distance. This view would demonstrate the student practicing and was sometimes a fair assessment of ergonomics, but did little to demonstrate instrumentation skill. Camera placement needed to be much closer to the instrument and dentoform in order to assess competency. Realizing this, the vOSCE orientation included webcam placement and lighting in relation to the students' dentoform which was different than the way they had been practicing.

What Went Well? Four open-ended questions were asked of students for the purpose of process evaluation. Their full responses can be seen in Appendix L, with abbreviated responses in Table 3, along with the most common findings, or codes, for each question. The first question was, 'what went well?'. Each of the 24 responses were varied, with the majority being related to instructor feedback, efficiency of process, verbalizing psychomotor skills, and their equipment set up.

Instructor feedback and efficiency of process were the two most common findings. Students viewed feedback as "constructive", "immediate", "good", and liked having "one-on-one time with different instructors." The vOSCE process was described as being "smooth", "on-time", had Zoom links that were "easy to follow" with appropriate timing, and thought of as "efficient and effective." Verbalizing psychomotor skills and equipment set up were the next two most commonly mentioned aspects that went well during the vOSCE. Students found it "easy to verbalize" their instrumentation process during the competency. Many reported that it was "easy for instructors to see their screen", and that their "lighting and dentoform positioning" went well.

Table 3

Student Responses Related to 'What Went Well?'

Thematic code	Selected student responses
Feedback	"I liked having one-on-one time with different instructors and receiving immediate feedback."
	"Constructive feedback during instrumentation helped a lot."
	"Each instructors had enough time to give me feedback."
	"Got good feedback from instructors about grasp and instrument stroke."
Efficiency of process	"I think this went well all around. Once we got the hang of going into different rooms, it made it go very smoothly."
	"The whole set up was great!"
	"Each of my zoom meeting went very smoothly and on time with the schedule."
	"Different links were easy to follow."
	"Efficient in time management from both instructor and student."
	"I think the timing went well. I finished every session at least 5 minutes early and didn't feel rushed."
Verbalizing psychomotor skill	"It was easy to verbalize what I did."
	"Verbalizing the instrumentation process."
Equipment set up	"It was comfortable on my part and the instructors were able to have a close view of what I was doing."
	"Trial run before hand with my camera view to see the best set up. Saved time and hassle."
	"Lighting and dentoform positioning. Looking at the picture that I took during the calibration weeks ago made re-creating it easy!"

Note. This table itemizes each student's response to the process evaluation question by thematic code.

What Did Not Go Well? Common findings, or codes, found within this section were related to technology, equipment set up, efficiency of process, grading, and ergonomics. Technology issues were most frequently mentioned by students, reporting "technical difficulties", "old computer and webcam," and a "lack of quality internet connection" as barriers to instructors being able to assess them effectively. Struggles with equipment set up included "dentoform positioning", damage to the dentoform from frequent practicing impacting their assessment, and making sure to have "appropriate lighting." Process efficiency was impacted by having too many Zoom links for one student, and another student wanted "better accountability of time" from both instructors and students.

Table 4

Student Responses Related to 'What Did Not Go Well?'

Thematic code	Selected student responses
Technology	"Poor connection. Old computer webcam."
	"Hard for instructors to clearly see because it is over zoom rather than in person."
	"Having previous student internet connection affect the following student."
Equipment set up	"Dentoform positioning."
	"Having to change the dentoform set up."
	"Hard to get the right lighting."
	"My dentoform teeth now have gouges in them that prevent me from having nice continuous strokes and sometimes cause me to slip off the tooth, the artificial gums are also damaged and sometimes get caught in my instrument even though I am positioned correctly."
Efficiency of process	"Each link to Zoom was different."
	"I hope there would be better accountability of time on instructors end and the students so that we don't overlap on the sessions."

Grading	"Printing out and reading through the competency forms in Canvas beforehand was helpful and I felt more comfortable. However, it seems like what students were given was different from the ones that instructors have (grading criteria and passing points), so I wish they were the same."
Ergonomics	"Hard to position self correctly in order to see where I was working."

Note. This table itemizes each student's response to the process evaluation question by thematic code.

What Would You Like to See Being Done Differently? The most commonly suggested area for improvement was process efficiency. One student would prefer the Zoom sessions to be "back to back" so they would not have a break in between competencies, and on the contrary, another student would prefer to not have them "back to back." Another suggestion was to have a different probing sequence that would have been "easier to follow." Having a "phone contact…to an instructor" in case of a failed Zoom link was suggested, along with having an "overflow instructor" for an assessment in case an instructor or student ran behind and caused another student to miss their scheduled assessment. Perhaps clarifying the availability of the overflow instructor and ways to communicate with that instructor could be reinforced during the orientation, as the faculty manager monitored student email and also held an active "overflow" Zoom link during each vOSCE session.

One student stated that although the vOSCE was a great alternative, "nothing will take the place of working in an operatory." This response was coded as a preference for an in-person instrumentation competency. In regard to verbalizing psychomotor skills, one student said that talking through the process "seemed repetitive." In terms of grading, one student suggested to remediate within that same session, "and work with the student

until they get it right." Finally, another student wishes there was a better way for instructors to view the instrumentation competency that, "didn't impinge on me being able to see."

Table 5

Student Responses Related to 'What Would You Like to See Being Done Differently?'

Thematic code	Selected student responses
Efficiency of process	"For probing sequence, maybe we could be more specific like 24-18 facial and 27-32 lingual would have been easier to follow."
	"I had a break in between, I would prefer it being back to back because I was already in the mentality for it."
	"Maybe put some extra time between each zoom and not having them all being back to back."
	"I wish we had a phone contact or something like that for emergency connections to an instructor in case of any issues (like the non-working zoom link)."
	"If a student/instructor runs behind, causing the following student to miss their competency, allowing that student to have their first attempt same day with the "overflow" instructor, rather than having to wait two weeks to have a first attempt."
Preference for in-person	"I think that it was done as good as it could be done. Nothing will take the place of working in an operatory. So this was a great alternative for us to test our skills from home."
Feedback	"15 minutes instead of 10 to discuss feedback more."
Verbalizing psychomotor skill	"I wasn't sure if I was supposed to talk through my process for every single tooth. It seemed repetitive."
Grading	"Instead of failing students and re-do in a brand new session, remediate what went wrong that same session and work with student until they get it right."
Technology	"I wish there was a way to have better camera views for instructor that didn't impinge on me being able to see. I had to turn my dentoform away from me so instructors could see but it made it hard for me to see."

Note. This table itemizes each student's response to the process evaluation question by thematic code.

Is There Anything Else You Would Like to Tell Us? The overwhelming common response to this open-ended question was gratitude. Twelve out of the 17 student responses expressed gratitude by saying, "thank you." They appreciated the "flexibility in completing…our requirements", and the "opportunity to work on requirements in advance", so they could "concentrate on their patients in clinic." Several students "loved" and "enjoyed" them and were "happy" to be able to do their instrument competencies over Zoom.

The next most popular response was related to process evaluation. One student found it "better than I expected", while another student stated that it was "super-efficient" and "easy to complete." A third student thought "it went very smoothly for being the first time trying this type of competencies." In-person preferences emerged with one student stating that they would "rather do these competencies on a real patient because the experience is completely different on a dentoform", and another student stated it was nice to have these competencies complete, but sees the "value of having this in-person, especially for newer students."

Table 6

Student Responses Related to 'Is There Anything Else You'd Like to Tell Us?'

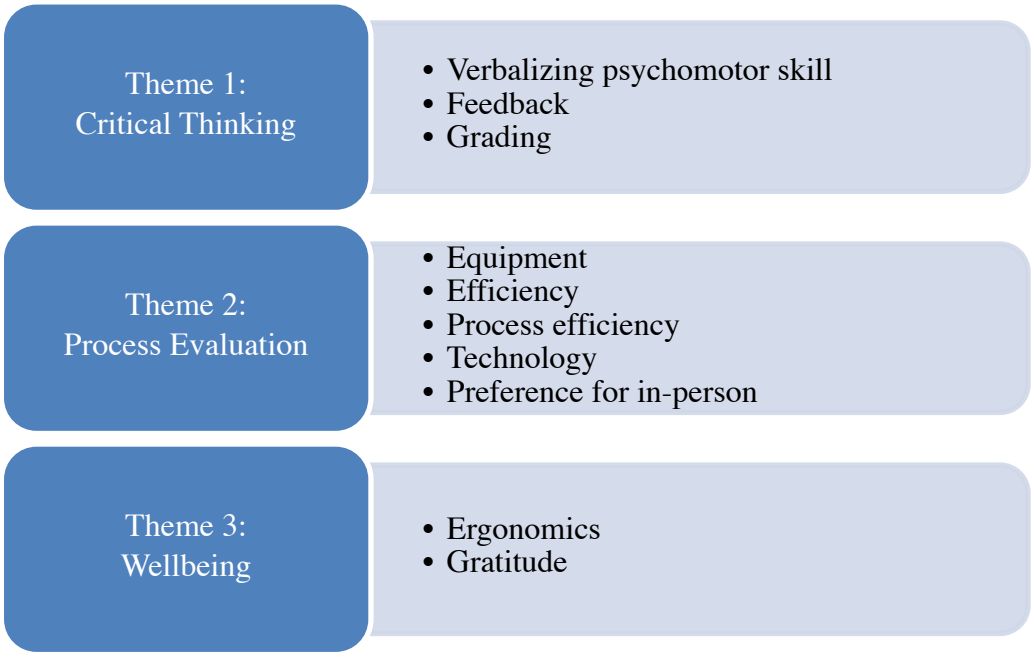
Thematic code	Selected student responses
Gratitude	"Thank you for doing this so we can concentrate on our patients in clinic." "Really appreciate the flexibility in helping us complete our requirements."
Efficiency of process	"It went better than I expected!" "I think it went very smoothly for being the first time trying this type of competencies." "Super-efficient with time, easy to complete in the 10 minute window. LOVE this idea!"
Preference for in-person	"I would much rather do these competencies on a real patient because the experience is completely different on a dentoform, at least for me it was." "It was nice to know that these aren't things that we will have to worry about coming back into clinic this summer but I do see the value of having this in person- especially for newer students."
Feedback	"Some instructors would give feedback like 'that lighting is perfect' or 'that looks good' or 'don't turn the dentoform' while I was instrumenting and I really liked that because when it's silent, it makes me really nervous and I make more mistakes. Even saying 'okay' is comforting."

Note. This table itemizes each student's response to the process evaluation question by thematic code.

Student Response Coding and Emerging Themes. Holistic analysis of this data set, as opposed to specific process evaluation question analysis, led to the sorting of common phrases and statements under the following same codes: equipment, technology, grading, feedback, verbalizing psychomotor skill, process efficiency, ergonomics, and gratitude. From these codes, emerging themes of critical thinking, process evaluation, and wellbeing were found (see Figure 11).

Figure 11

Student Coding and Emerging Themes



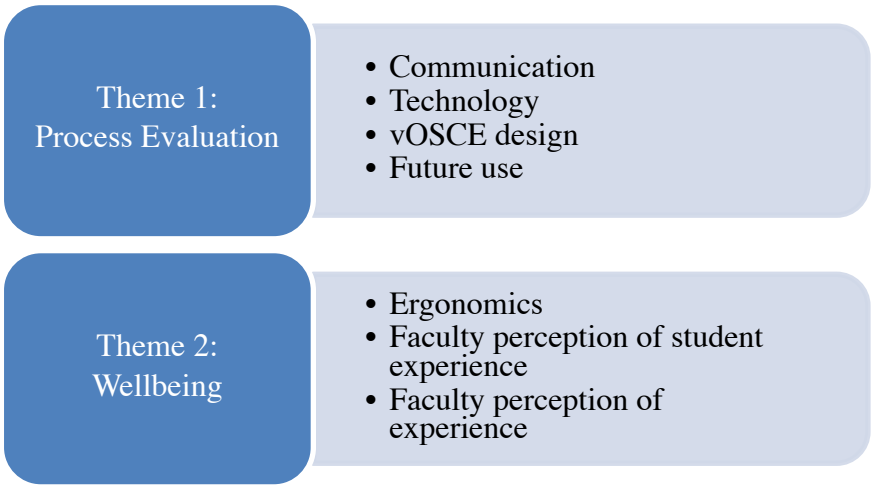
Faculty Respondents

Faculty interviews were led by the principle investigator during each de-briefing post-vOSCE. Additional, unsolicited faculty feedback was also submitted via email correspondence. Four faculty members participated in the vOSCE instructor calibration orientation and in the actual vOSCE for instrumentation competencies for students. After the first session, all four faculty said they had felt prepared enough to participate in the virtual instrumentation competencies held via Zoom, and no recommendations were made to help faculty feel more prepared. Faculty said they "felt very prepared", and that the "beforehand faculty calibration session was so valuable and informative, covering all the material needed for the virtual competencies." Another faculty member stated, "the practice session…allowed me to feel very comfortable with how it would work with students."

The analysis of the faculty interview data including sorting like statements and comments into codes and then the codes were organized into themes. Codes found were: communication, technology, vOSCE design, future use of vOSCEs, ergonomics, faculty perception of student experience, and faculty perception of experience. Themes found were process evaluation and wellbeing.

Figure 12

Faculty Coding and Emerging Themes



Process Evaluation. Communication, technology, vOSCE design, and future use codes were grouped together under the process evaluation theme (see Table 4). Faculty responses within the communication code included appreciation for having access to student feedback, enjoyment of "meeting up" and having "conversations after each session" to discuss what went well, what did not, and ways to improve. Another respondent said that it was "nice being able to text each other during the competency" in the event there were difficulties. Technology concerns were also mentioned, specifically "video quality for some students was not ideal" and faculty being "not so familiar with Zoom technology."

Instrumentation competency design was a large part of process evaluation. Faculty acknowledged "all the work it must have taken", including "a lot of organization and coordination." Indeed, the vOSCE activity took exactly seven hours over the course of three weeks to complete. Orientation and calibration took an additional three hours over two separate days, and uncounted hours to analyze, design, and develop. One faculty member commended "implementing this exercise." Another faculty member appreciated being able to "refer back to the orientation document for links and evaluation submissions." A suggestion was made to calibrate faculty on verbiage in order to provide students with "good directions for correction." Regarding the faculty calibration where we piloted the vOSCE format, a respondent said that it allowed her to "feel very comfortable with how it would work with students." This same faculty member states that she attended the student calibration and found it "helpful knowing how they were preparing."

Future use of vOSCEs was mentioned by respondents in faculty feedback sessions. Three of the four respondents spoke directly to the future use of vOSCEs, while one stated they were "grateful" for the new idea. The other faculty members said they hoped "to utilize this format again", and that after several sessions of practice, another respondent said she "really was able to see that virtual competencies might just be something we want to incorporate into our program in some way." Finally, another faculty member stated that they "see a future for virtual instrumentation competencies in dental hygiene programs as well as more online calibration sessions and meetings."

Table 7

Faculty Responses Related to Process Evaluation by Code

Code	Faculty Responses
Communication	"It was nice being able to text each other during the competencies, and knowing you were there to help with difficulties."
	"I also especially loved our conversations after each session."
	"Thank you for sending the student feedback."
	"I enjoyed meeting up after each session and going over what worked a concerns we had."
Technology	"Video quality for some students was not ideal."
	"You…were patient with some of us not so familiar with Zoom."
vOSCE Design	"It took a lot of organization and coordination."
	"Only suggestions would be to have all the faculty calibrated on verbiage to be able to give each student good directions for correction."
	"I really appreciated being able to refer back to the orientation document for links and evaluation submissions."
	"Thank you for all of the work it must have taken to make these competencies happen."
	"The practice session also allowed me to feel very comfortable with how it would work with students. I did join the student calibration and was glad I did so. It was helpful knowing how they were preparing."
Future Use	"I hope we are able to utilize this format again in the future."
	"By the end of the third session, I really was able to see that virtual competencies might just be something we want to incorporate into our program in some way."
	"I see a future for virtual instrumentation competencies in dental hygiene programs as well as more online calibration sessions and meetings."
	"I am grateful for you and all the new ideas you bring to our program."

Note. This table itemizes faculty responses to the process evaluation question by thematic code.

Wellbeing. Ergonomics, faculty perception of student experience, and faculty perception of experience codes were grouped together under the emerging them of wellbeing (see Table 5). Ergonomics seemed to have been favorable for one faculty member during instrumentation observation, while another faculty member mentioned that "positioning for the student was challenging." Faculty perception of the students' experience seemed overall positive, with one respondent stating that "it looked like they found it to be time well spent." Another respondent thought the students found the competencies "valuable." A third respondent mentioned that they "really liked students verbalizing what they were doing", and that they thought "this helps with their learning."

Faculty perception of the vOSCE experience was overall positive. Respondents "loved participating", "enjoyed the new experience", and described it as "awesome and so much fun." One respondent stated being "so glad to be a participant of this process", while another noted being receptive to "trying new things…and found them so valuable to our students." One faculty member stated that "overall, this was a great learning experience." And finally, one respondent acknowledged that vOSCEs were "great for practicing, but in-person instrumentation competencies are vital and does not have a real replacement as far as quality goes."

Table 8

Faculty Responses Related to Wellbeing by Code

Code	Faculty Responses
Ergonomics	"It is…also better ergonomically for the instructors to observe instrumentation; got to save our backs!"
	"Positioning for the student was challenging."
Faculty Perception of Student Experience	"Overall, it looked like they (students) found it to be time well spent."
	"I really liked students verbalizing what they were doing, I think this helps with their learning."
	"I loved participating in these competencies and found them so valuable to our students. I think the students did too!"
"Faculty Perception of Experience	"I enjoyed the new experience it gave me."
	"I liked being able to give specific feedback."
	"I loved participating in these competencies and found them so valuable to our students."
	"The project was awesome and so much fun."
	"I am all for trying new things and getting out of one's comfort zone. We have been doing it the same way since I started and it's refreshing to do things a little different."
	"I was so glad to be a participant of this process."
	"Overall, this was a great learning experience."
	"I think these were great for practicing, but in person instrumentation competencies are vital and does not have a real replacement as far as quality goes."

Note. This table itemizes each faculty member's response to process evaluation questions which were then sorted into codes.

Student and Faculty Experience Similarities

Themes of process evaluation and wellbeing were both found to emerge within student and faculty data, with technology, vOSCE design, feedback, verbalizing psychomotor skill, and future use codes being shared. Both students and faculty experienced technical difficulties

related to internet connectivity or difficulty with their assessment due to the quality of webcams, or both. The vOSCE design was considered effective and efficient from the majority of the respondents' perspectives and believed it to be an overall positive teaching and learning experience. One faculty and two student respondents showed a preference for in-person competencies compared to virtual, stating there is no replacement for actual patient care. However, a suggestion was made by one student respondent to provide virtual competencies for newer students who were just beginning to learn instrumentation. Finally, student respondents favored the immediate, constructive feedback they were given by faculty related to their instrument grasp and stroke, dentoform positioning, and lighting.

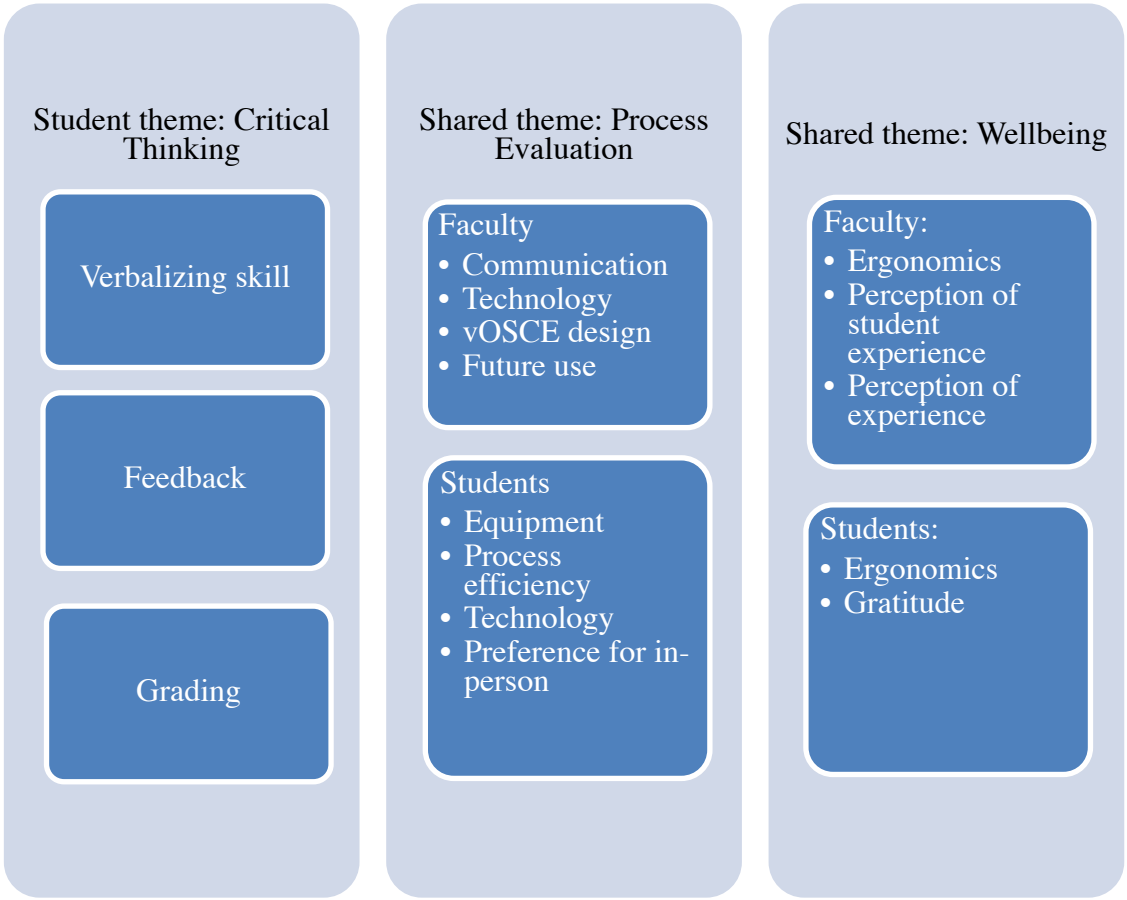
All respondents have a shared code of verbalizing psychomotor skill. For faculty, this sub-code was within the vOSCE design code in the process evaluation theme. For students, this code was sorted under the theme of critical thinking. While some students found verbalizing their psychomotor skill "easy", another student "wasn't sure if I was supposed to talk through my process for every single tooth", and thought "it seemed repetitive." Their responses show perhaps an acknowledgement of procedural knowledge which relates to critical thinking. Faculty perception of the students' experience acknowledged this as well, stating that they "really liked students verbalizing what they were doing" and thought "this helps with their learning."

Both faculty and students shared gratitude for the new experience of virtual instrumentation competencies. Students stated they were thankful for the opportunity to progress in their clinical requirements during campus closures, and faculty were appreciative for the new teaching and learning strategy. Future use of vOSCEs in the dental hygiene program was supported by the majority of respondents, with 20 students recommending continuing the virtual

competency format with future students while four students were undecided. All faculty saw vOSCEs as an appropriate means for practicing instrumentation, with three respondents wishing to utilize this format again in the future and incorporating virtual competencies into the dental hygiene program clinical curriculum.

Figure 13

Student and Faculty Themes and Associated Codes



Student and Faculty Experience Differences

Differences were found among student and faculty responses related to wellbeing and critical thinking themes, specifically in the ergonomic and grading codes. Faculty thought virtual instrumentation competencies were "better ergonomically" than the traditional clinical setting, as observing students from their Zoom links allowed them to

"save our backs." Meanwhile, two student respondents wished there was a better way for instructors to see their dentoforms "that didn't impinge on me being able to see." Another student described having to turn their dentoform away from themselves "so instructors could see but it made it hard for me to see."

Two students commented on grading, with one suggesting to "remediate what went wrong that same session and work with the student until they get it right", as opposed to waiting for the assigned remediation session. Another student stated that printing out the competency forms used for grading was helpful and comforting, but felt students were given forms "different from the ones that instructors have" regarding grading criteria and passing points. Clinical instrumentation competency forms were amended for the virtual space, eliminating criteria such as student position, mirror, lighting, and infection control (see Appendix H).

Discussion

Summary of Major Findings

The primary goal of this study was to discover what implications there may be for future formative vOSCE use in dental hygiene programs. By asking respondents process evaluation questions related to vOSCE orientation and implementation, future actions related to vOSCE use in dental hygiene programs can now be identified. Analysis of the data produced three main themes which contributed to answering the research question: wellbeing, process evaluation, and critical thinking.

Wellbeing

Virtual OSCEs may contribute to the wellbeing of students and faculty. The theme of wellbeing included coding related to the perceptions of both faculty and student experience for faculty respondents, while student coding included gratitude. A common code between both faculty and student respondents was ergonomics.

Respondents from both student and faculty groups stated an improvement in ergonomics during virtual instrumentation competencies compared to in-person competencies, while two students reported difficulties being able to see their dentoform at the same time as the faculty member providing the assessment. Faculty perception of both their own and student experiences was overall positive, leaving respondents with feelings of enjoyment and value for time spent during participation. Faculty referred to the vOSCEs as a great learning experience, found it to be valuable for both themselves and students, and were grateful for the opportunity to teach in a new and refreshing way. Finally, student respondents expressed overwhelming gratitude for the opportunity to

work on clinical requirements prior to returning to campus, appreciated the flexibility to make progress in their clinical skills, and acknowledged the effort and dedication involved in creating the virtual competencies.

Recommendations to improve ergonomics would be to incorporate either a wearable action camera for students, such as a GoPro™ camera, or to establish a universal tripod mounting for both camera and dentoform that the student would be able to maneuver around ergonomically as they instrumented.

Process Evaluation

The emergent theme of process evaluation for students and faculty was anticipated, as was the original intent of surveying students and faculty feedback sessions. Codes found within faculty data were communication, vOSCE design, and future use of vOSCEs. Student respondent coding included equipment, efficiency, and a preference for in-person competencies. Both faculty and student respondent data included a code for technology.

The vOSCE design was considered effective and efficient from the majority of the respondents' perspectives and believed it to be an overall positive teaching and learning experience. Both students and faculty experienced technical difficulties related to internet connectivity or difficulty with their assessment due to the quality of webcams, or both. Two students and one faculty member stated a preference for in-person competencies, as they did not feel virtual instrumentation practice was a substitute for actual patient interaction.

A majority of all respondents would recommend the future use of vOSCEs as a supplemental activity related to patient care. Three of the four faculty respondents spoke directly to the future use of vOSCEs, saying they hoped "to utilize this format again", and that they were

"able to see that virtual competencies might just be something we want to incorporate into our program in some way." Finally, another faculty member stated that they "see a future for virtual instrumentation competencies in dental hygiene programs as well as more online calibration sessions and meetings."

A recommendation for future vOSCE design was to ask students to practice with their equipment in the same way they would be assessed. At vOSCE orientation, clarify the intent of the vOSCE was not to replace patient care, but to enhance or supplement clinical skill and critical thinking development. For implementation of vOSCEs, technology and equipment recommendations include ensuring a stable internet connection and basic webcam quality criteria, in addition to a uniform equipment set up such as a wearable action camera or standardized table mount.

Critical Thinking

Virtual OSCEs may contribute to the development of critical thinking. Student data revealed a theme of critical thinking, with coding of verbalizing psychomotor skills, feedback, and grading. Faculty had similar coding of their perception of the vOSCE experience in relation to verbalizing psychomotor skill and feedback. For students, instructor feedback was a common response to what had gone well during the vOSCE. Students viewed feedback as "constructive", "immediate", "good", and liked having "one-on-one time with different instructors." Faculty responses within the communication code included appreciation for having access to student feedback. A suggestion was made by a faculty member to calibrate faculty on verbiage in order to provide students with "good directions for correction."

Students found it "easy to verbalize" their instrumentation process during the competency, while one student said that talking through the process "seemed repetitive." From the faculty perspective, they "really liked students verbalizing what they were doing", as they thought "this helps with their learning." For grading, one student suggested to remediate within that same session, "and work with the student until they get it right."

In the future, it is recommended to clarify the purpose of verbalizing psychomotor skill, as this oration demonstrates procedural knowledge for the student and also helps the faculty member to recognize the student's knowledge of the instrumentation process. In the event the view of the instructor is blocked during the virtual competency, the students' words narrates what part of the process they are performing until the faculty member is able to see again. Recommendations for grading include ensuring both students and faculty utilize the same competency form edited for the virtual format and to calibrate faculty on remediation verbiage.

Theoretical Implications

The theoretical implication of this study was that virtual OSCEs are a viable active learning and assessment strategy that may foster critical thinking development for millennial students and enhance the wellbeing of faculty and student participants. Practical implications for future vOSCE use in dental hygiene programs related to process evaluation were identified.

Findings Related to Millennials and Critical Thinking

The short, multimedia format of vOSCEs coincides with the educational preferences of millennials; to learn by doing, and having structured learning units with immediate feedback (Beebe et al., 2014). Formative vOSCEs are an example of problem-based learning, which utilizes active rather than traditional passive, lecture-based teaching methods, which has been established as a mechanism to foster critical-thinking skills (Bonwell & Eison, 1991; Michel et al., 2009). This study's findings is supportive of current evidence that vOSCEs may foster critical thinking skills.

In a clinical setting, active learning strategies include experiential and problem-based learning (PBL). The latter, in particular, shows a statistically significant improvement on students' clinical performance due to the promotion of higher-order cognition skills such as critical and evaluative thinking (Harris & Bacon, 2019; Prince, 2004). The critical thinking theme found within student data included verbalizing psychomotor skill, feedback, and grading.

The purpose of asking students to verbalize their instrumentation process was two-fold. Mainly, to facilitate advancement through the essential components of critical thinking, which are being aware of declarative and procedural knowledge, or knowing the concepts of instrumentation and how to present this during their competency, and to recognize their metacognition, or having the ability to examine what they are doing compared to their competency criteria, and adjusting accordingly if needed (Facione, 1990; Huba & Freed, 2000). The second purpose of asking students to verbalize their instrumentation skill was to allow faculty an opportunity to understand what the student was doing with their instrument in relation to the dentoform if the student's webcam

became obscured due to equipment positioning. One student found this repetitive, while most thought verbalizing what they were doing was easy and was a component of what they thought went well during the vOSCE. Faculty agreed with student findings, and thought that verbalizing their instrumentation process was helpful to student learning. Receiving immediate feedback, an overwhelming positive response from students, and grading related to their instrumentation is also an essential part of developing the core skills and disposition of the ideal critical thinker (Facione, 1990).

Findings Related to Previous vOSCE Research

Several studies had been published in the short amount of time since being required to provide learning and assessments remotely. Previously published research related to vOSCEs coincided with the implementation of this study's vOSCE. The literature review of vOSCE research revealed many similarities in design, implementation, and findings. Emerging themes from these early published articles demonstrated that virtual OSCEs are able to assess all aspects of essential activities that OSCEs assess with the exception of physical skills, and that a vOSCE is a viable formative assessment (Ali, 2020; Boursicot et al., 2020; Lara et al., 2020; Major et al., 2020). Students reported learning more due to the instant feedback they received after completing their tasks (Ali, M., 2020). Results of this study are consistent with these previous findings. Dental hygiene students and faculty respondents from this cohort study also found vOSCEs as an overall positive experience for instrumentation competencies, yet recognized physical skill, such as direct patient contact, was still necessary.

Each researcher in these studies described the methods used to implement a virtual OSCE, with all except one, using Zoom online conferencing with timed breakout

sessions, a simulation, and standardized checklists or rubric for instructor evaluation (Ali, M., 2020; Boursicot et al., 2020; Lara et al., 2020; Major et al., 2020). Student and faculty orientations or pilot vOSCEs were also implemented as a means to prepare participants. These design and implementation elements are consistent with this study's methodology. Zoom online conferencing was used to conduct assessments, email and texting was used as a back-up communication, and testing the vOSCE which doubled as a training for faculty (Lara et al., 2020; Major et al., 2020).

Findings Related to Previous Faculty and Student OSCE Perceptions

Multiple research studies have focused on both student and faculty opinions of OSCEs within a variety of healthcare disciplines. Common themes related to student and faculty perceptions of the OSCE within these articles reveal that the OSCE was viewed as a fair assessment for clinical skills yet can produce high anxiety for students (Fidment, 2012; Nazzawi, 2018; Perry et al., 2015; Puryer, 2016). Even with this negative outcome, there was strong support for the OSCE. The overall recommendation was to emphasize student and staff preparation to reduce anxiety (Fidment, 2012; Nazzawi, 2018).

Findings within this study are supportive of the perception that vOSCEs are a fair assessment and overall a positive experience, yet did not find that the vOSCE experience produced high levels of anxiety for students. On the contrary, students and faculty reported sentiments of gratitude and appreciation which can be contributed to their wellbeing. Perhaps this was related to 21 out of 24 students and all four faculty reporting feeling prepared to participate in the vOSCE due to the orientation and faculty calibration exercises.

Limitations

Methodological limitations include a lack of informed consent from both dental hygiene student and faculty respondents. This was entirely due to the retrospective nature of the study. All students and faculty participated in every aspect of the vOSCE orientation and implementation and answered related process evaluation questions on their own free will. However, it was not known at the time there would be value in looking further into how their responses might influence the development of virtual educational models in dental hygiene programs other than for immediate process evaluation. Due to this limitation, issues of respondent confidentiality have been protected by not disclosing demographic information, including the name of the educational institution or year of study student respondents were in at the time of the vOSCE implementation.

The author acknowledges they are also the PI and the vOSCE designer and implementer. Student and teacher relationships may produce issues related to power and control. Through continuous modeling of transparency in teaching and learning, respondents had both positive and negative responses, indicating that students did not feel threatened by the teacher to respond freely.

Generalizability of findings beyond the sample studied are limited by the lack of descriptive statistics related to sample demographics. Due to the retrospective nature of the study, informed consent was not given to share this information. Assumptions are made that the student cohort are within the millennial generation based on college enrollment and student demographic statistics (Bustamante, 2019).

Limitations to process evaluation include not recording faculty feedback sessions which would have improved validity. Asking questions directly related to active learning and assessment strategies and critical thinking instead of only process evaluation would have also improved the study's results. Not doing so was related to the study's retrospective nature.

Recommendations and Suggestions for Future Research

Future research recommendations echo that of recently published virtual OSCE studies, which was a perceived need for telemedicine research and training (Ali, M., 2020; Lara et al., 2020; Major et al., 2020). Although these research articles are related to pharmacology, pediatrics, and obstetrics and gynecology disciplines respectively, dental hygienists are a competent workforce model to address access to care issues of vulnerable populations. Telehealth training would be necessary as direct providers in schools, senior-focused communities, and eventually working inter professionally as dental therapists in community clinics or urgent care facilities as practice laws evolve.

Process evaluation revealed several recommendations for improving the virtual framework for OSCEs, specifically related to design, technology, and equipment. Clarifying the intent of the vOSCE as a means to enhance clinical skill and critical thinking development, asking students to practice with their equipment the way they would be assessed, and ensuring stable internet connection with basic webcam quality criteria may produce different results than this study's findings.

Applying recommendations for ergonomics, verbalizing psychomotor skills, and grading may also improve the results of this study in the areas of wellbeing and critical thinking. Future studies may want to look at how a wearable action camera, such as a

GoPro™ camera might improve faculty's observation without disturbing the student's ability to see their own instrumentation. The GoPro™ feed could be displayed on a secondary platform such as Flipgrid©. The student would use Flipgrid© to record their competency while the instructor evaluated ergonomic criteria by watching the student on Zoom. Once the student finished instrumenting, they would post their recording on Flipgrid©. The student and the faculty member would then watch the submitted video and critically assess their strengths and weaknesses together. It may even be beneficial for critical thinking development if the student completed an instrumentation competency rubric for self-evaluation. Utilizing both Zoom and Flipgrid© in this way would allow for the evaluation of the student's ergonomics, provided they use a tri pod dentoform mount and appropriate chair. Ergonomic evaluation criteria was missing from this study's and would further contribute to student wellbeing. Finally, continued research in the area of utilizing a virtual framework for OSCEs may consider larger populations, multiple dental hygiene programs for comparison to one another, or simply repeating the virtual instrumentation competencies within the same cohort with all recommendations made for improvement in place.

New questions surfaced from this research. How will millennials impact student learning as educators? How will their successors, Gen Z, shape future changes in our educational programs? It would be particularly interesting to see how Gen Z's shared experiences of political and civil unrest, COVID-19 closures of public spaces including primary and secondary schools, and experiencing remote learning from the youngest of school ages up will shape their unique learning needs.

Conclusions

Student-centered and evidence-based educational programs are charged to consider a new approach from traditional teaching and learning in order to fully engage millennials, who have come to expect the use of technology in education (Beebe et al., 2014). The short, multimedia format of vOSCEs coincides with the educational preferences of millennials; to learn by doing, and having structured learning units with immediate feedback (Beebe et al., 2014). For millennials, the recent adoption of a virtual framework for teaching through simulation was a disruptive innovation resulting in better engagement of study habits, increased learning due to the low risk nature, the promotion of critical and evaluative thinking, and being able to better identify gaps in student knowledge (Harris & Bacon, 2019; Pugh et al., 2018; Tedesco-Schneck, 2013; Weiler, 2004).

The goal of this qualitative, retrospective phenomenological cohort analysis was to assess dental hygiene student and clinic faculty experience with vOSCEs to determine what implications there may be for future formative vOSCE use in dental hygiene programs. The essence of the vOSCE can be described as an overall positive experience with support for incorporating this formative and summative assessment into dental hygiene program clinical curriculum. The theoretical implication of this study is that virtual OSCEs are a viable active learning and assessment strategy that may foster critical thinking development for millennial students and enhance the wellbeing of faculty and student participants. Practical implications for future vOSCE use in dental hygiene programs related to process evaluation were identified.

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Appendix A

Faculty Orientation Agenda

Faculty Calibration: Virtual Instrumentation Competency (VIC)
June 1st, 2020; 3:30-4:30

3:30-4:10: Review this form, Q&A
4:10-4:30: Test Zoom links and actual process

Dates of student competency sessions:

- Month/Day
- Month/Day
- Month/Day

All VICs are from 1-3:00, with a faculty debrief from 3:00-3:20

Student schedule is here: Instrumentation Process Evaluation Schedule (link removed)

For Each Session of the VIC

- Faculty will have a text thread to communicate with each other
  - Technology issues
  - Student issues
  - Schedule issues
- Have a copy or view the schedule during the session.
- Before the session, use the schedule to prepare your modified clinic competency forms
  - Save each Word document as your student's first name, last initial and instrument. Then minimize on your desktop/laptop. Examples:
    - Student A.13/14
    - Student B.13/14
    - Student C.13/14
- Enter your Zoom link that is on the schedule.
- Once your student enters the waiting area, allow them to enter the meeting at their appointed time.
- 10 minutes starts now!
  - Set a 10 min timer on your phone that starts at the appointment time, not the time the student starts or stops.
- Ensure dentoform position and lighting is adequate.
- Remind students of the proper instrumentation sequence.
- Remind students to verbalize what they are doing, as they are doing it.
  - Does not need to be a memorization of clinic form, but it should be evident to you that they know what they are supposed to be doing.
  - This step will show their critical thinking.
  - This step will help you connect what you are seeing with what they are doing in the event the instrument is obstructed for a moment or two.
- Share results of the competency with your student
  - Pass/Fail
  - Main areas for improvement
- Student will leave the meeting and go to their next Zoom
- Start the above process over again by admitting the next student on your schedule from the waiting area.

Faculty Calibration: Virtual Instrumentation Competency (VIC)
June 1st, 2020; 3:30-4:30

Final Thoughts

Please keep track of student names who do not pass so I can create the 2nd attempt schedule

Timing will be a big factor in the success of these VICs
If a student is more than 4 minutes late:

- advise them to leave your waiting area and go to their next scheduled competency
- they will have an opportunity to make it up on Friday, June 19th.

Document student no-shows.

Faculty Debrief (3:00-3:20)

- To discuss pass/fail rate
- To identify no-shows (they may have just been late and asked to skip)
- To discuss how to improve for next session

Once the session is complete, go to DHYG 432A in Canvas and upload your clinic forms to the Virtual Competencies folder.

- Select Files on the left-hand column
- Scroll all the way down to Virtual Competencies folder
- Select 'Upload' and choose your documents

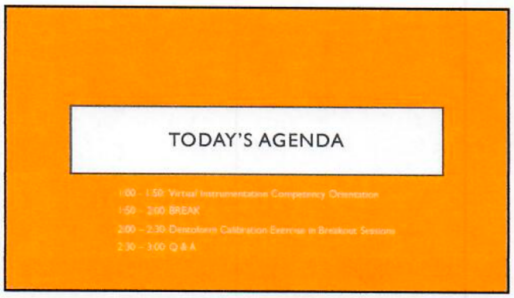
Test Zoom Links and Process

Instrumentation Process Evaluation Schedule Via Zoom

Process Evaluation Schedule				
	Instructor #1 -UNC Probe *Join Zoom Here:*	Instructor #2 - Universal Curette (5/6 or 4R/4L) *Join Zoom Here:*	Instructor #3 - Gracey 11/12 *Join Zoom Here:*	Instructor #4-Gracey 13/14 *Join Zoom Here:*
		Faculty #1	Faculty #3	Faculty #2
		Faculty #2	Faculty #1	Faculty #3
		Faculty #3	Faculty #2	Faculty #1
	BREAK	BREAK	BREAK	BREAK

Appendix B

Virtual Instrumentation Competencies Student Orientation (Active Link)



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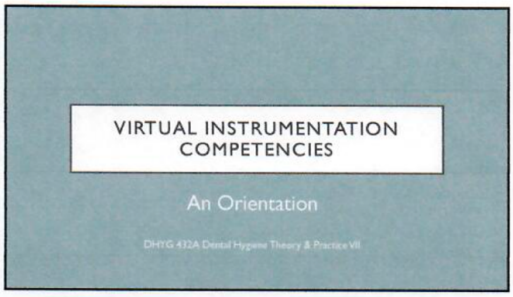

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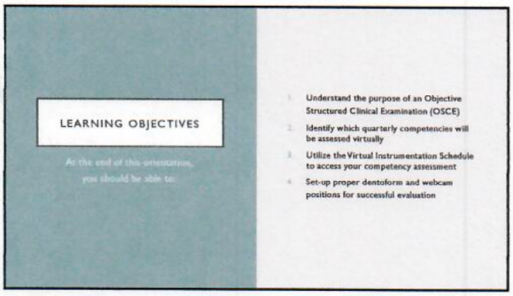

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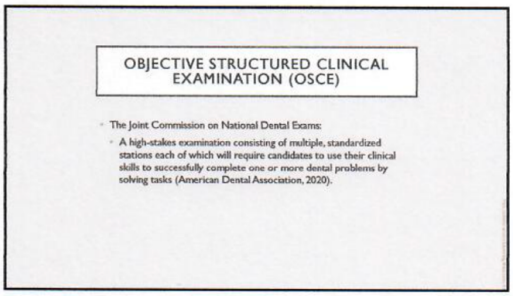

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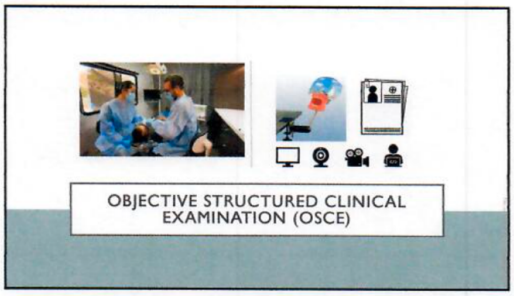

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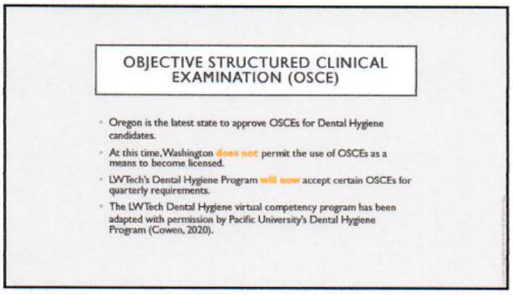

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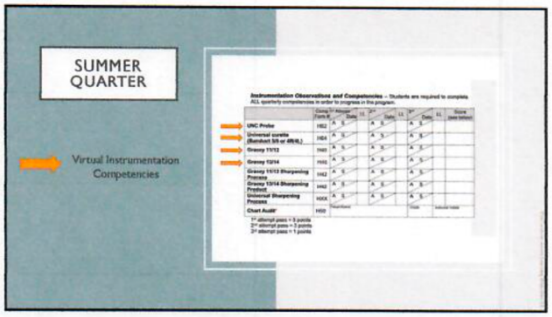

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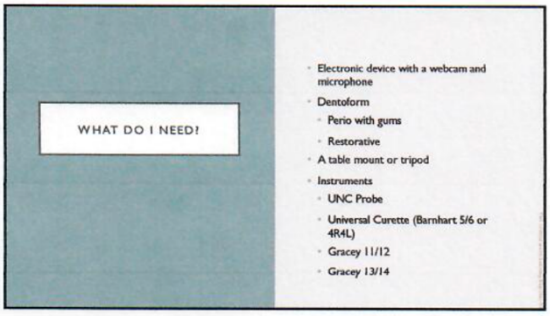

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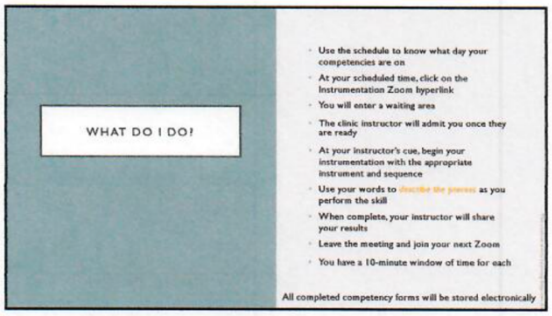

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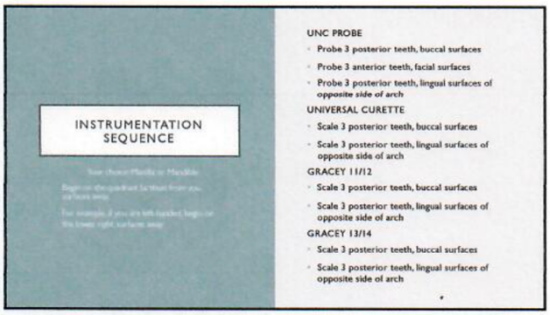

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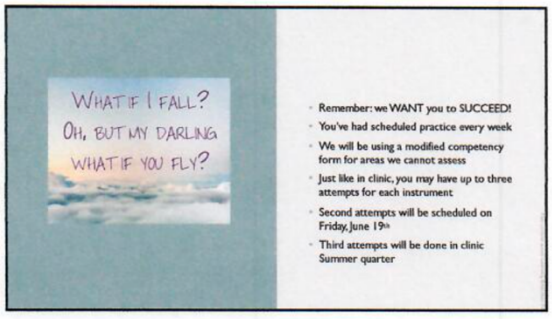

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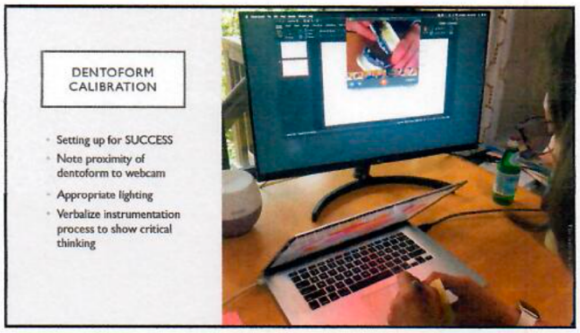

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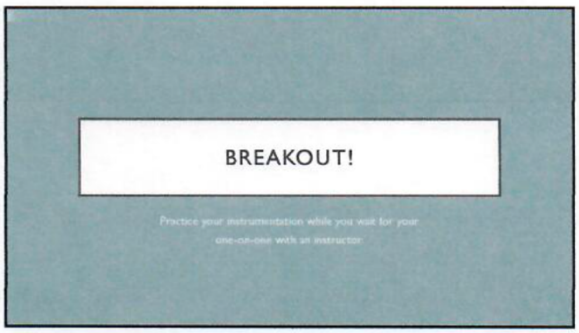

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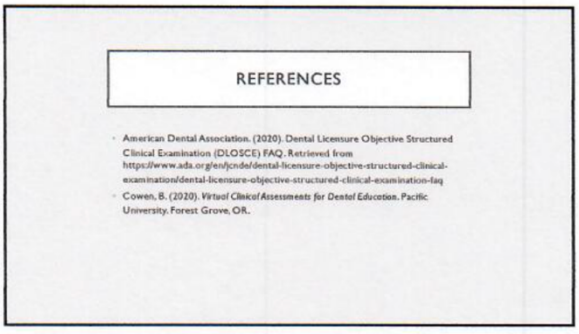

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Appendix C

Virtual Instrumentation Competency Schedule (Active Link)

Instrumentation Process Evaluation Schedule Via Zoom

Session 1: Thursday, Week 1 Process Evaluation Schedule

	Instructor #1 -UNC Probe *Join Zoom Here:*	Instructor #2- Universal Curette (5/6 or 4R/4L) *Join Zoom Here:*	Instructor #3 - Gracey 11/12 *Join Zoom Here:*	Instructor #4 -Gracey 13/14 *Join Zoom Here:*
1:00	Student A	Student K	Student J	Student I
1:10	Student B	Student A	Student K	Student J
1:20	Student C	Student B	Student A	Student K
1:30	Student D	Student C	Student B	Student A
1:40	Student E	Student D	Student C	Student B
1:50	BREAK	BREAK	BREAK	BREAK
2:00	Student F	Student E	Student D	Student C
2:10	Student G	Student F	Student E	Student D
2:20	Student H	Student G	Student F	Student E
2:30	Student I	Student H	Student G	Student F
2:40	Student J	Student I	Student H	Student G
2:50	Student K	Student J	Student I	Student H
3:00-3:20	Faculty Only: Debrief with Leads Zoom Link Goes Here			

Session 2: Thursday, Week 2 Process Evaluation Schedule

	Instructor #1 -UNC Probe *Join Zoom Here:*	Instructor #2- Universal Curette (5/6 or 4R/4L) *Join Zoom Here:*	Instructor #3 - Gracey 11/12 *Join Zoom Here:*	Instructor #4 -Gracey 13/14 *Join Zoom Here:*
1:00	Student L	Student V	Student U	Student T
1:10	Student M	Student L	Student V	Student U
1:20	Student N	Student M	Student L	Student V
1:30	Student O	Student N	Student M	Student L
1:40	Student P	Student O	Student N	Student M
1:50	BREAK	BREAK	BREAK	BREAK
2:00	Student Q	Student P	Student O	Student N
2:10	Student R	Student Q	Student P	Student O
2:20	Student S	Student R	Student Q	Student P
2:30	Student T	Student S	Student R	Student Q
2:40	Student U	Student T	Student S	Student R
2:50	Student V	Student U	Student T	Student S
3:00-3:20	Faculty Only: Debrief with Leads Zoom Link Goes Here			

Session 3: Thursday, Week 3 Process Evaluation Schedule

	Instructor #1 -UNC Probe *Join Zoom Here:*	Instructor #2- Universal Curette (5/6 or 4R/4L) *Join Zoom Here:*	Instructor #3 - Gracey 11/12 *Join Zoom Here:*	Instructor #4 -Gracey 13/14 *Join Zoom Here:*
1:00	Student W	Student GH	Student EF	Student CD
1:10	Student X	Student W	Student GH	Student EF
1:20	Student Y	Student X	Student W	Student GH
1:30	Student Z	Student Y	Student X	Student W
1:40	Student AB	Student Z	Student Y	Student X
1:50	BREAK	BREAK	BREAK	BREAK
2:00	Student CD	Student AB	Student Z	Student Y
2:10	Student EF	Student CD	Student AB	Student Z
2:20	Student GH	Student EF	Student CD	Student AB
2:30	*			
2:40				
2:50				
3:00-3:20	Faculty Debrief/scheduled 2nd attempts Zoom: Zoom Link Goes Here			

*Empty cells are for students who need 2nd attempts.

Appendix D

Instrumentation Competency Student Survey

1. Did you feel prepared enough to participate in the virtual instrumentation competencies held via Zoom?
2. If no to the above question, what would have helped you feel more prepared?
3. What went well?
4. What did not go well?
5. What would you like to see being done differently?
6. Would you recommend us to continue this virtual competency format with future students?
7. Is there anything else you want to tell us?

Appendix E

Instrumentation Competency Faculty Feedback Questions

1. Did you feel prepared enough to participate in the virtual instrumentation competencies held via Zoom?
2. If no to the above question, what would have helped you feel more prepared?
    a. The above questions were asked at the first Faculty Debrief interview only.
3. What went well?
4. What did not go well?
5. What can we do to improve?

Appendix F

Lake Washington Institute of Technology Letter of Support

LAKE WASHINGTON INSTITUTE OF TECHNOLOGY
Practical. Purposeful. Promising.

11605 132nd Avenue NE | Kirkland, Washington 98034
p: (425) 739-8100 | f: (425) 739-8298 | LWTech.edu

November 2, 2020

Re: Research Project – Retrospective, qualitative analysis of perceptions of Objective Structures Clinical Examination (OSCE).

CC: Cindy Ko, Associate Dean

Dear Ms. Whitcomb:

This letter confirms that the Institutional Effectiveness and Planning Committee (IPEC) at Lake Washington Institute of Technology (LWTech) has reviewed your request to conduct the research study as described in your proposal. The letter serves as documentation of support of the project.

Since the study will use non-identifiable participant information, results will not be published, and the project will be recorded through Eastern Washington University's (EWU) Institutional Research office as a Quality Assurance project, the College has determined that your study is exempt from IRB review.

If you need to make changes to this project's design or implementation that may constitute the addition of research activities, alteration of planned activities to include research, and/or publishing results outside of the class assignment parameters, you must notify IPEC and receive formal approval before proceeding with any changes.

Please let us know if we can provide any additional information. We look forward to supporting your work.

Sincerely,

Suzanne Ames

Dr. Suzanne Ames
Vice President of Instruction
Lake Washington Institute of Technology
suzanne.ames@lwtech.edu
425-739-8410

Appendix G

Inclusion Criteria

Student Inclusion (Informants *must*)	Faculty Inclusion (Informants *must*)
Be a minimum of 18 years of age	Be currently employed by LWTech in the Dental Hygiene program
Be currently enrolled as a student at Lake Washington Institute of Technology's dental hygiene program	Be willing to attend a faculty calibration and each student competency session as a volunteer clinic instructor
Have participated in the orientation of and virtual instrumentation competencies	Be willing to attend Faculty Debrief interviews following student sessions

Appendix H

Original and Modified Clinic Process Evaluation Forms

Highlighted areas on original have been removed from the virtual form.

SKILL COMPETENCY CHECKLIST: Periodontal Probe Technique
Process Observation

Student:_____

Date #1: _____ Sextant or Quad # _____ Pt Name: _____
Date #2: _____ Sextant or Quad # _____ Pt Name: _____
Date #3: _____ Sextant or Quad # _____ Pt Name: _____

Student Instructions: After the competency, reflect and answer the following question: *How will I improve in the areas identified?*

Evaluator Instructions: Indicate **A** (Acceptable), **I** (Improvable) or **S** (Standard Not Met) in the "E" Column below. Each **A** equals 2 points, **I** equals 1 point, **S** equals 0 points.

CRITERIA	1st E	2nd E	3rd E
STUDENT POSITION			
Positioned correctly on clinician stool.			
Positioned correctly in relation to patient, equipment, and treatment area.(Clock Positions)			
Establishes correct head position (patient and operator).			
Maintains correct ergonomic positions (neutral spine, elbow and shoulder).			
MIRROR			
Uses correct grasp and establishes secure rest with mirror.			
Uses the mirror correctly for retraction, indirect vision and/or lighting.			
GRASP			
Thumb and index finger pads positioned opposite one another on handle; fingers not touching or overlapped.			
Pad or side of middle finger rests lightly on shank; touches ring finger.			
Handle rests between the 2nd and 3rd knuckle of the index finger and **not** in the "V" of the hand.			
Bends fingers slightly.			
Bends thumb knuckle out, or straight (not collapsed)			
Wrist maintains a neutral or slightly bent downward position.			
Grasp is very relaxed (no blanching of fingers).			
FULCRUM			
Ring finger is straight and supports weight of hand.			
Fulcrum is solid, stable and close to area.			
Uses standard intraoral or alternative finger rests correctly. Stand up or down on fulcrum			
Repositions to change adaptation of terminal shank by rocking up or down on fulcrum. (using the shoulder elbow and wrist as a unit)			
INSTRUMENTATION			
Begins stroke at Distal, then proceeds mesially and switches at midline.			
Uses light short walking stroke circumferentially.			
Demonstrates thorough coverage of tooth beginning at the base of the sulcus and finishing in the col.			
IP—back of probe against contact, tip angled slightly to reach under contact (col area).			
Maintains 1-2 mm of tip on tooth.			
Maintains correct adaptation; probe parallel to long axis of tooth.			
No finger motion (moves hand and wrist as a unit).			
Probe handle is in correct position. No cross arch position or straight out in the anterior.			
Stays in sulcus.			
Uses correct sequence in sextant.			
LIGHTING			
Maintains adequate overhead lighting throughout procedure.			
INFECTION CONTROL			
Student maintains all aspects of infection control.*			
Student provides specific insightful goals to improve in areas identified.			
SCORE			
	I.I.	I.I.	I.I.

*Area of critical non-competence; student will need to re-attempt performance competency

F1: 45/60 W1: 48/60 SP1: 50/60 SU1: 52/60 F2: 53/60 W2: 56/60

VIRTUAL SKILL COMPETENCY CHECKLIST: Periodontal Probe Technique
Process Observation

Date #1: _____ Sextant or Quad # _____ Pt Name: _____
Date #2: _____ Sextant or Quad # _____ Pt Name: _____
Date #3: _____ Sextant or Quad # _____ Pt Name: _____

Student: _____

Evaluator Instructions: Indicate **A** (Acceptable), **I** (Improvable) or **S** (Standard Not Met) in the "E" Column below. Each **A** equals 2 points, **I** equals 1 point, **S** equals 0 points.

CRITERIA	1st **E**	2nd **E**	3rd **E**
GRASP Thumb and index finger pads positioned opposite one another on handle; fingers not touching or overlapped.			
Pad or side of middle finger rests lightly on shank; touches ring finger.			
Handle rests between the 2nd and 3rd knuckle of the index finger and **not** in the "V" of the hand.			
Bends fingers slightly.			
Bends thumb knuckle out, or straight (not collapsed)			
Wrist maintains a neutral or slightly bent downward position.			
Grasp is very relaxed (no blanching of fingers).			
FULCRUM Ring finger is straight and supports weight of hand.			
Fulcrum is solid, stable and close to area.			
Uses standard intraoral or alternative finger rests correctly. Stand up or down on fulcrum			
Repositions to change adaptation of terminal shank by rocking up or down on fulcrum. (using the shoulder elbow and wrist as a unit)			
INSTRUMENTATION Begins stroke at Distal, then proceeds mesially and switches at midline.			
Uses light short walking stroke circumferentially.			
Demonstrates thorough coverage of tooth beginning at the base of the sulcus and finishing in the col.			
IP—back of probe against contact, tip angled slightly to reach under contact (col area).			
Maintains 1-2 mm of tip on tooth.			
Maintains correct adaptation; probe parallel to long axis of tooth.			
No finger motion (moves hand and wrist as a unit).			
Probe handle is in correct position. No cross arch position or straight out in the anterior.			
Stays in sulcus.			
Uses correct sequence in sextant.			
SCORE			
	I.I.	I.I.	I.I.

F1: 45/60 W1: 48/60 SP1: 50/60 SU1: 52/60 F2: 53/60 W2: 39/42 SP2: 40/42

Student's Score: /42

Pass/Fail

Instructor: _____

SKILL COMPETENCY: Area-Specific Curet (Anterior or Posterior)
Instrumentation Process Evaluation

Student: _____

Date #1: _____ Tooth #'s: _____ Sextant # _____ Pt name: _____
Date #2: _____ Tooth #'s: _____ Sextant # _____ Pt name: _____
Date #3: _____ Tooth #'s: _____ Sextant # _____ Pt name: _____

Student Instructions: After the competency, reflect and answer the following question: *How will I improve in the areas identified?*

Evaluator Instructions: Indicate **A** (Acceptable), **I** (Improvable) or **S** (Standard Not Met) in the "E" Column below. Each **A** equals 2 points, **I** equals 1 point, **S** equals 0 points.

	1st Attempt	2nd Attempt	3rd Attempt
CRITERIA	**E**	**E**	**E**
Preparation: Instrument is sharp and ready to go.			
Appropriate patient selection.			
Student utilizes periodontal chart and radiographs.			
Grasp: Thumb/index finger pads positioned opposite one another or index finger slightly higher; thumb/index finger not touching or overlapped.			
Pad of middle finger rests lightly on shank and middle finger touches ring finger.			
Handle rests between the 2nd knuckle of the index finger and the "V" of the hand.			
Bends fingers slightly.			
Bends thumb knuckle out.			
Wrist maintains a neutral or slightly bent downward position.			
Fulcrum: Ring finger is straight and supports weight of hand.			
Fulcrum is solid and stable.			
Uses standard intraoral, extraoral, or alternative finger rests correctly.			
Instrumentation: Utilizes correct working end of instrument.			
Establishes & maintains correct face-to-tooth surface angulation of 60-80° (shank parallel to the long axis of the tooth).			
Pivots on fulcrum to activate stroke and access all tooth surfaces.			
Maintains first 1-2 mm of blade on tooth as the working stroke is engaged.			
Rolls handle to maintain toe adaptation to the tooth surface.			
Applies appropriate stroke in a coronal direction.			
Demonstrates multi-directional strokes for calculus removal.			
Keeps initial working strokes short, overlapping, and firm.			
Completes with longer, lighter controlled strokes.			
Utilizes wrist/forearm action to engage instrument (no finger motion).			
Accomplishes instrumentation maintaining all aspects of ergonomics.			
Lighting: Maintains adequate overhead lighting throughout procedure.			
Trauma: Induces as little trauma as possible.			
Infection Control: Student maintains all aspects of infection control.*			
Student provides specific insightful goals to improve in areas identified.			
SCORE			
	I.I.	**I.I.**	**I.I.**

*Area of critical non-competence; student will need to re-attempt performance competency

Scoring Pass Rates: **Su2** 46/54 **F2** 48/54 **W2** 49/54 **Sp2** 51/54

Student's Reflection Response:

VIRTUAL SKILL COMPETENCY: Area-Specific Curet (Anterior or Posterior)
Instrumentation Process Evaluation

Date #1: _____ Tooth #'s: _____ Sextant # _____ Pt name: _____
Date #2: _____ Tooth #'s: _____ Sextant # _____ Pt name: _____
Date #3: _____ Tooth #'s: _____ Sextant # _____ Pt name: _____

Student: _____

Evaluator Instructions: Indicate **A** (Acceptable), **I** (Improvable) or **S** (Standard Not Met) in the "E" Column below. Each **A** equals 2 points, **I** equals 1 point, **S** equals 0 points.

	1st Attempt	2nd Attempt	3rd Attempt
CRITERIA	**E**	**E**	**E**
Grasp: Thumb/index finger pads positioned opposite one another or index finger slightly higher; thumb/index finger not touching or overlapped.			
Pad of middle finger rests lightly on shank and middle finger touches ring finger.			
Handle rests between the 2nd knuckle of the index finger and the "V" of the hand.			
Bends fingers slightly.			
Bends thumb knuckle out.			
Wrist maintains a neutral or slightly bent downward position.			
Fulcrum: Ring finger is straight and supports weight of hand.			
Fulcrum is solid and stable.			
Uses standard intraoral, extraoral, or alternative finger rests correctly.			
Instrumentation: Utilizes correct working end of instrument.			
Establishes & maintains correct face-to-tooth surface angulation of 60-80° (shank parallel to the long axis of the tooth).			
Pivots on fulcrum to activate stroke and access all tooth surfaces.			
Maintains first 1-2 mm of blade on tooth as the working stroke is engaged.			
Rolls handle to maintain toe adaptation to the tooth surface.			
Applies appropriate stroke in a coronal direction.			
Demonstrates multi-directional strokes for calculus removal.			
Keeps initial working strokes short, overlapping, and firm.			
Completes with longer, lighter controlled strokes.			
Utilizes wrist/forearm action to engage instrument (no finger motion).			
SCORE			
	I.I.	**I.I.**	**I.I.**

*Area of critical non-competence; student will need to re-attempt performance competency

Scoring Pass Rates: **Su2** 46/54 **F2** 48/54 **W2** 49/54 Sp2 36/38

Student's Score: /38

Pass/Fail

Instructor: _____

SKILL COMPETENCY CHECKLIST: Universal Curet (Anterior or Posterior)
Process Evaluation

Student: _____
Date #1: _____ Sextant # or Quad _____ Pt name: _____
Date #2: _____ Sextant # or Quad _____ Pt name: _____
Date #3: _____ Sextant # or Quad _____ Pt name: _____

Student Instructions: After the competency, reflect and answer the following question: *How will I improve in the areas identified?*

Evaluator Instructions: Indicate **A** (Acceptable), **I** (Improvable) or **S** (Standard Not Met) in the "E" Column below. Each **A** equals 2 points, **I** equals 1 point, **S** equals 0 points.

CRITERIA	E (1st)	E (2nd)	E (3RD)
PREPARATION			
Student utilizes periodontal chart and radiographs.			
Instrument is sharp and ready to go.			
STUDENT POSITION			
Positioned correctly on clinician stool.			
Positioned correctly in relation to patient, equipment, and treatment area. (clock positions)			
Establishes correct head position (patient and operator).			
Maintains correct ergonomic positions (neutral spine, elbow and shoulder).			
MIRROR			
Uses correct grasp and establishes secure rest with mirror.			
Uses the mirror correctly for retraction, indirect vision and/or lighting.			
GRASP			
Thumb and index finger pads positioned opposite one another, or index finger slightly higher; not touching or overlapped.			
Pad or side of middle finger rests lightly on shank; touches ring finger.			
Handle rests between the 2nd and 3rd knuckle of the index finger and **not** in the "V" of the hand.			
Bends fingers slightly.			
Bends thumb knuckle out, or straight (not collapsed)			
Wrist maintains a neutral or slightly bent downward position.			
FULCRUM			
Ring finger is straight and supports weight of hand.			
Fulcrum is solid, stable and close to area.			
Uses standard intraoral or alternative finger rests correctly. Stands up or down on fulcrum.			
Repositions to change areas/pivots (using the shoulder elbow and wrist as a unit) toward tooth rocks on fulcrum to activate stroke (using a wrist motion no finger).			
INSTRUMENTATION			
Utilizes correct end of instrument.			
Sets the tip, maintains correct adaptation on line angle by rolling handle forward or back			
Establishes and maintains correct face-to-tooth surface angulation (shank tilted at 60-80 degrees).			
Maintains 1-2 mm of blade on tooth.			
Makes 1st pivot uses light, overlapping strokes of appropriate length. Makes 2nd pivot terminal shank is up against tooth and close to the contact, tip is apical.			
Uses controlled calculus removal strokes in a coronal direction.			
Applies appropriate stroke pressure in a coronal direction.			
Utilizes wrist/forearm action to move instrument (no finger motion).			
Demonstrates horizontal strokes at (1) midline of anterior teeth and (2) line angles of posterior teeth.			
Keeps initial working strokes short, overlapping, firm and stays on the tooth.			
Completes with longer and lighter root planning strokes.			
LIGHTING			
Maintains adequate overhead lighting throughout procedure.			
TRAUMA			
Induces as little trauma as possible.			
INFECTION CONTROL			
Student maintains all aspects of infection control.*			
Student provides specific insightful goals to improve in areas identified. (see back)			
SCORE	I.I.		

*Area of critical non-competence; student will need to re-attempt performance competency

W1: 54/66 **SP1:** 55/66 **Su2:** 57/66 **F2:** 59/66 **W2:** 61/66 **SP2:** 63/66

VIRTUAL SKILL COMPETENCY CHECKLIST: Universal Curet (Anterior or Posterior)
Process Evaluation

Student: _____
Date #1: _____ Sextant # or Quad _____ Pt name: _____
Date #2: _____ Sextant # or Quad _____ Pt name: _____
Date #3: _____ Sextant # or Quad _____ Pt name: _____

Student: _____

Evaluator Instructions: Indicate **A** (Acceptable), **I** (Improvable) or **S** (Standard Not Met) in the "E" Column below. Each **A** equals 2 points, **I** equals 1 point, **S** equals 0 points.

CRITERIA	E (1st)	E (2nd)	E (3RD)
GRASP Thumb and index finger pads positioned opposite one another, or index finger slightly higher; not touching or overlapped.			
Pad or side of middle finger rests lightly on shank; touches ring finger.			
Handle rests between the 2nd and 3rd knuckle of the index finger and **not** in the "V" of the hand.			
Bends fingers slightly.			
Bends thumb knuckle out, or straight (not collapsed)			
Wrist maintains a neutral or slightly bent downward position.			
FULCRUM Ring finger is straight and supports weight of hand.			
Fulcrum is solid, stable and close to area.			
Uses standard intraoral or alternative finger rests correctly. Stands up or down on fulcrum.			
Repositions to change areas/pivots (using the shoulder elbow and wrist as a unit) toward tooth rocks on fulcrum to activate stroke (using a wrist motion no finger).			
INSTRUMENTATION Utilizes correct end of instrument.			
Sets the tip, maintains correct adaptation on line angle by rolling handle forward or back			
Establishes and maintains correct face-to-tooth surface angulation (shank tilted at 60-80 degrees).			
Maintains 1-2 mm of blade on tooth.			
Makes 1st pivot uses light, overlapping strokes of appropriate length. Makes 2nd pivot terminal shank is up against tooth and close to the contact, tip is apical.			
Uses controlled calculus removal strokes in a coronal direction.			
Applies appropriate stroke pressure in a coronal direction.			
Utilizes wrist/forearm action to move instrument (no finger motion).			
Demonstrates horizontal strokes at (1) midline of anterior teeth and (2) line angles of posterior teeth.			
Keeps initial working strokes short, overlapping, firm and stays on the tooth.			
Completes with longer and lighter root planning strokes.			
SCORE	I.I.		

W1: 54/66 **SP1:** 55/66 **Su2:** 57/66 **F2:** 59/66 W2: 39/42 SP2: 40/42

Student's Score: /42

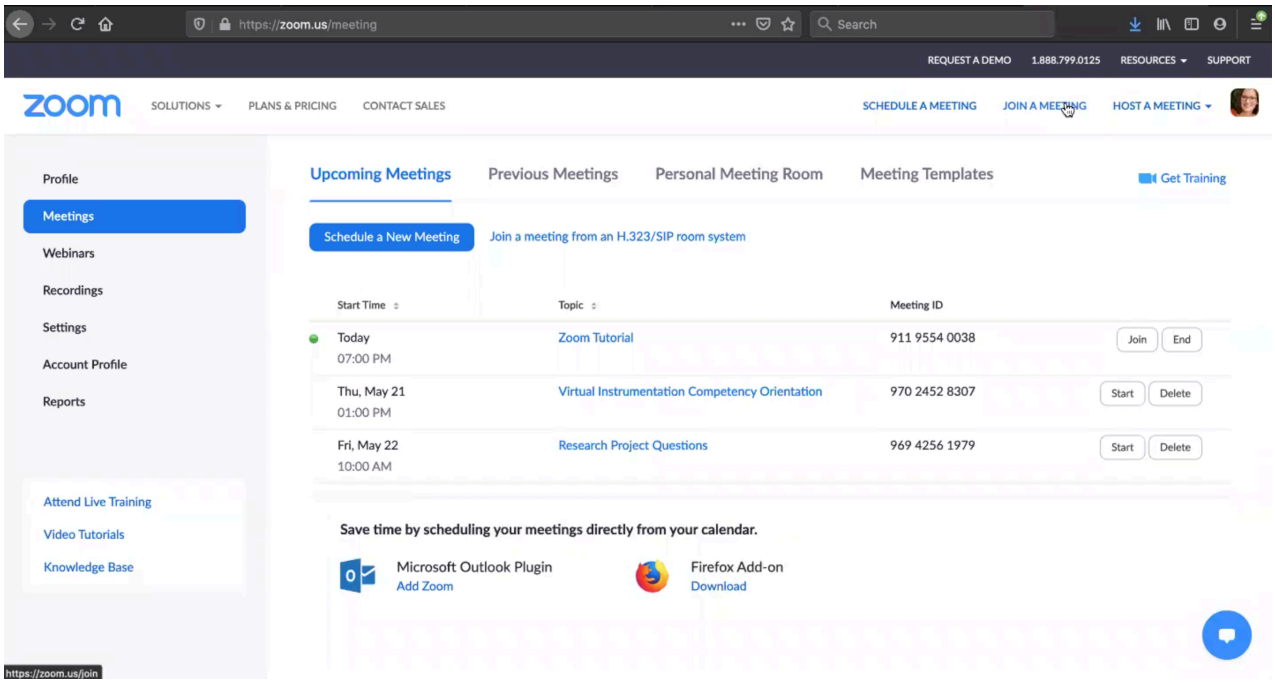
Pass/Fail

Instructor: _____

Appendix I

Virtual Instrumentation Competencies Calibration Zoom Tutorial (Whitcomb, 2020)

CLICK HERE FOR ACCESS



Appendix J

Student Orientation Lesson Plan (Active Link)

Title: vOSCE Student Orientation	**Course:** Dental Hygiene Theory and Practice VI			
Topic: Virtual Instrument Competencies	**Students:** 30 **Faculty:** 3			
General Goal	**Total Time:** 2 hours			
Performance Objective #1 Understand the purpose of OSCEs **Performance Objective #2** Identify quarterly competencies to be assessed virtually **Performance Objective #3** Utilize the virtual instrumentation schedule to access competency assessment	**Time** 1:00-1:50	**Instructional Strategies** **Teacher Activities**	**Learner Activities**	**Resources, Materials, and Technology**
	Pre-Instructional	**Develop Preparation Materials** • Modify clinic process evaluation forms • Create Student schedule for vOSCE • Hold faculty calibration • Develop Orientation PPT **Activities** • Motivational statement to include remedy for lack of progress in clinical requirements and skill development • Clarify objectives • Confirmation of knowledge and skills to start virtual assessments	**Complete preparation activities:** • Students have quarterly requirement documents • Students have utilized clinic process evaluation forms • Students will review virtual competency schedule in Canvas prior to orientation **Activities** • Forms opinion about vOSCE	**Resources** ADEA Just in Time Series Webinar on Virtual Clinic Assessments (Cowen, 2020) **Materials** • Student Orientation PPT • Clinic process evaluation forms • Dentoforms • Table mount or tri-pod • UNC Probe • Universal curet • Gracey 11/12 • Gracey 13/14 **Technology:** • Instrumentation practice assignments in LMS • Laptop with webcam and audio • Internet • Zoom
	Instructional	**Evidence-based active learning strategy:** • Presentation of OSCE to include what it is and how it is utilized • Discussion of which instrument competencies will be included • Demonstration of how to access and read student schedule • Discussion of what resources students need and how to utilize them during their vOSCE	**Student activities** • Recall knowledge and skills already possessed about topic • Contribute to discussion related to terms, concepts, or process	All resources as above
	Post-Instructional	• Reinforce our desire for them to succeed • Summarize their preparedness • Share action plan for after break is to sort out into small groups for one on one calibration with faculty	• Determine the tasks that will require the most attention during the practice session	All resources as above
BREAK 1:50-2:00 (10 min)				

Performance Objective #4 Demonstrate proper dentoform and webcam positions for successful evaluation	**Time** 2:00-2:30	**Instructional Strategies** **Teacher Activities**	**Learner Activities**	**Resources, Materials and Technology**
	Pre-Instructional	**Develop Preparation Materials** • Assign three breakout rooms; 1:10 faculty to student **Activities** • Recall vOSCE process from faculty calibration to facilitate student calibration	**Preparation activities:** • Prepare armamentarium for guided practice	**Resources:** • Previous Theory & Practice courses with lab • Fundamentals of Periodontal Instrumentation (Gehrig et al., 2017) • Reinforced Periodontal Instrumentation and Ergonomics (Millar, 2008) **Materials:** • Clinic process evaluation forms • Dentoforms • Table mount or tri-pod • UNC Probe • Universal curet • Gracey 11/12 • Gracey 13/14 **Technology:** • Instrumentation practice assignments in LMS • Laptop with webcam and audio • Internet • Zoom
	Instructional 2:00-2:20 (20 min)	**Evidence-based active learning strategy:** • Guided instrumentation practice using simulation in small group breakout sessions • Direct ideal armamentarium set up for viewing on webcam • Discuss variety of unique scenarios for each student due to lighting, seating, webcam quality • Recommend appropriate changes in set up as necessary	**Student activity** • Participate in calibration exercise • Peer learning by observation • Independent practice when not in one on one session • Share challenges in set up of armamentarium	All resources as above
	Post-Instructional	• Provide opportunity for each student to correct his or her dentoform/instrument/webcam positioning	• Apply feedback to psychomotor skills or webcam/dentoform positioning	All resources as above
Main Room Questions & Answers	**Time** 2:30 -3:00	**Teacher Activities**	**Learner Activities**	All resources as above
	Instructional	• **Evidence-based active learning strategy:** • Provide additional information about what most students struggled with during simulation • Student-led discussion, socratic questioning	• Ask questions based on experiential learning	All resources as above
	Post-Instructional	• Inform students of ungraded anonymous survey in Canvas • Evaluate Instrumentation Competency Student survey for common themes	• Contribute to Instrumentation Competency Student Survey	**Technology** • Anonymous ungraded quiz in Canvas LMS • Internet

Appendix K

Virtual Clinic Assessment Sample Materials (Cowen, 2020)

Courses » **Virtual Clinical Assessments**

Virtual Clinical Assessments

COVID-19 has impacted the way students and teachers approach clinical assessments. Without access to live patients, alternative means to demonstrate and assess mastery of clinical topics are needed. Dental educators are now tasked with virtually assessing students to maintain continuation of their education.

This webinar discusses how Pacific University has virtually assessed students' clinical skills, using typodonts and Objective Structured Clinical Examinations (OSCEs). Access to sample materials from Pacific University are also provided.

Learning Objectives:

1. Identify resources and platforms to facilitate virtual clinical assessments.
2. Discuss how the use of table rods, typodonts and standardized cases can be used for student home assessments via video conferencing.
3. Recognize the value of OSCEs and rubrics in virtual clinical assessments.

CE information:

The American Dental Education Association is an ADA CERP Recognized Provider.

An evaluation form is available to participants after the conclusion of the webinar. To earn continuing education (CE) credit for participation in the webinar, the online evaluation must be completed in full by May 1, 2023. After completing the evaluation, webinar participants can print and save the CE Verification Form.

ADA CERP is a service of the American Dental Association to assist dental professionals in identifying quality providers of continuing dental education. ADA CERP does not approve or endorse individual courses or instructors, nor does it imply acceptance of credit hours by boards of dentistry.

The American Dental Education Association designates this activity for 1.0 continuing education credit.

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All speakers agree that neither they nor members of their immediate family have any financial relationships with commercial entities that may be relevant to their presentation.

Appendix L

Student Responses Related to vOSCE Process Evaluation

What went well? Common findings: feedback, efficiency of process, verbalizing psychomotor skills, and equipment set up
• Sharpen instruments to ensure the right sound that indicate appropriate angulation. • Verbalize the instrumentation process • Instructor feedback • I think this went well all around. Once we got the hang of going into different rooms, it made it go very smoothly. • The whole set up was great! It was comfortable on my part and the instructors were able to have a close view of what I was doing. Constructive feedback during instrumentation helped a lot. • Talking through competency; easy for instructors to see work. • I did my best to make the perfect view of my dentoform for the instructors to make it easier for them to grade me, and they loved the position of the dentoform and camera. • Quick. Zoom was on time. good feedback. • Teachers were kind and gave good feedback. • Each of my zoom meeting went very smoothly and on time with the schedule. My camera and mic was working well. Each instructors had enough time to give me feedback. • Went pretty quickly • It was easy to verbalize what I did. • Efficient in time management from both instructor and student • Verbalizing what my actions were. • The instructors were able to see my screen clearly and give me feedback after each session. • Given the chance to change position of dentoform, chair, mount before starting and not getting point deducted. • I liked having one-on-one time with different instructors and receiving immediate feedback. • Trial run before hand with my camera view to see the best set up. Saved time and hassle. • Instructor feedback! • Different links were easy to follow. • Lighting and dentoform positioning. Looking at the picture that I took during the calibration weeks ago made re-creating it easy!

- I think the timing went well. I finished every session at least 5 minutes early and didn't feel rushed.
- I think it was very well organized, and I like the plan if we ended up waiting too long (the 4 min). That was a relief to know instead of wondering. I received good feedback and it was great to see the instructors one on one.
- Got good feedback from instructors about grasp and instrument stroke
- Great feedback, quick and easy!

What did not go well?
Common findings: equipment set up, efficiency of process, ergonomics, technology, and grading

- dentoform positioning
- Everything went well
- I thought the whole procedure was efficient and effective in looking at our skills.
- Hard to position self correctly, in order to see where I was working.
- It was pretty smooth and good.
- Poor connection, old computer and webcam
- I thought the virtual competencies went better than I expected.
- Technical difficulties
- The issue with a quality Internet connection put my competency under the risk of failure. The instructor wasn't happy and couldn't assess me well. Each link to Zoom was different. I mean- some links directly sent to Zoom, some sent you to a website where I had to log in to my Zoom account (of course I didn't remember the password), the third link didn't work at all.
- Making sure to have appropriate lighting (operator error)
- My dentoform teeth now have gouges in them that prevent me from having nice continuous strokes and sometimes cause me to slip off the tooth, the artificial gums are also damaged and sometimes get caught in my instrument even though I am positioned correctly.
- Having previous student internet connection affect the following student. And having to change the dentform set up.
- Nothing, it went really well for me
- Hard to get the right lighting, although having a higher quality camera on my MacBook helped with clarity.
- I hope there would be better accountability of time both on instructors end and the students so that we don't overlap on the sessions.
- Printing out and reading through the competency forms in Canvas beforehand was helpful and I felt more comfortable. However, it seems like what students were given was different from the ones that instructors have (grading criteria and passing points), so I wish they were the same. Also, an instructor mentioned something that does NOT appear to be on the checklist and graded me down. While it is beneficial for me, I felt a

- dentoform
- Everything
- I thought t skills.
- Hard to po
- It was pret
- Poor conne
- I thought t
- Technical
- The issue risk of fail Each link t Zoom, son account (o work at all
- Making su
- My dentof having nic tooth, the a my instrun
- Having pre And havin
- Nothing, it
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little surprised and disappointed because I am on the edge of passing or failing. • I didn't notice anything that didn't go well. • I did not have a bad experience or situation • Hard for instructors to clearly see because it is over zoom rather than in person • Nothing that I can think of!
What would you like to see being done differently? Common findings: efficiency of process, preference for in-person, feedback, verbalizing psychomotor skill, grading, and technology
• For probing sequence, maybe we could be more specific like 24-18 facial and 27-32 lingual would have been easier to follow. • I had a break in between, I would prefer it being back to back because I was already in the mentality for it. • I think that it was done as good as it could be done. Nothing will take the place of working in an operatory. So this was a great alternative for us to test our skills from home. • Maybe put some extra time between each zoom and not having them all back to back. • 15 minutes instead of 10 to discuss feedback more • I wasn't sure if I was supposed to talk through my process for every single tooth. It seemed repetitive • I wish we had a phone contact or something like that for emergency connections to an instructor in case of any issues (like the none-working zoom link). • Instead of failing students and re-do in a brand new session, remediate what went wrong that same session and work with student until they get it right. • If a student/instructor runs behind, causing the following student to miss their competency, allowing that student to have their first attempt same day with the "overflow" instructor, rather than having to wait two weeks to have a first attempt. • I wish there was a way to have better camera views for instructor that didn't impinge on me being able to see. I had to turn my dentoform away from me so instructors could see but it made it hard for me to see
Is there anything else you would like to tell us? Common findings: Gratitude, efficiency of process, preference for in-person, feedback
• Really appreciate the flexibility in helping us complete our requirements • Thank you for letting us do virtual competencies! • Some instructors would give feedback like "that lighting is perfect" or "that looks good" or "don't turn the dentoform" while I was instrumenting and I really liked that because when it's silent, it makes me really nervous and I make more mistakes. Even saying "okay" is comforting. • Thank you for allowing us to do these competencies over Zoom

- Thank you!
- Thank you for taking your time to making this virtual competency
- No. thank you for this option!
- I really enjoy the competencies via zoom, happy we have been able to do them.
- It went better than I expected!
- I would much rather do these competencies on a real patient because the experience is completely different on a dentoform, at least for me it was.
- Super-efficient with time, easy to complete in the 10 minute window. Would save time for future students if they were able to complete competencies over zoom rather than in clinic.
  LOVE this idea!
- Thank you.
- Thank you for giving us the opportunity to work on requirements in advance!
- It was nice to know that these aren't things that we will have to worry about coming back into clinic this summer but I do see the value of having this in person- especially for newer students.
- Thank you for doing this so we can concentrate on our patients in clinic.
- I think it went very smoothly for being the first time trying this type of competencies
- Thank you for working so hard for us! Your effort and dedication does not go unnoticed.

Curriculum Vita

Kellie Whitcomb RDH, BSDH, MSDH
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206-818-1418

EDUCATION

Master of Science in Dental Hygiene **August 2017—May 2021**
Eastern Washington University, Summa Cum Laude

Bachelor of Science in Dental Hygiene **September 2015—May 2017**
Eastern Washington University, Summa Cum Laude

Associate of Applied Science Degree, Dental Hygiene **September 2007—June 2009**
Lake Washington Institute of Technology, Magna Cum Laude

Prerequisite classes for Dental Hygiene **September 2004—June 2007**
North Seattle Community College, Dean's List recipient

Dental Assistant Program **August 1996—September 1997**
Eaton Technical Institute, Dean's List recipient

LICENSURE AND CERTIFICATION

Registered Dental Hygienist, DH 60082963 **2009—Present**
Washington State Department of Health
School Sealant and Fluoride Varnish Approved

Dental Assistant Registration, D1 60094745 **2009—Present**
Washington State Department of Health

Community Instructor, Training Program #WA753080 **2016—2020**
Washington State Department of Social and Health Services
Aging and Long-Term Support Administration

Certified Dental Assistant, 186806 **2003—2015**

Dental Assisting National Board, Inc.

BLS for Healthcare Providers, CPR and AED **1997—Present**
American Heart Association

EMPLOYMENT EXPERIENCE

Lake Washington Institute of Technology **September 2018-Present**
Associate Professor, Senior Lead, Dental Hygiene Program
Facilitate the learning of adult students in both didactic and clinical settings. I follow evidence-based learning strategies, such as Universal Design for Learning, Transparency in Learning and Teaching, and utilize technology whenever possible. When developing curriculum and resources, accessibility is a priority.

Teaching Philosophy: I believe education enriches lives by challenging beliefs and expanding perspectives. My role as a teacher is to lead by guiding so my students can achieve their potential and have a positive influence on those around them. My personal values of integrity, honesty, and compassion for others helps me connect with my students, as well as being sensitive to my learner's needs, cultural influences, and learning styles.

I have a natural preference for a progressive adult learning philosophy where my style is learner-centered. The learning environment I strive to create encourages active inquiry and problem-focused collaboration that simulates real-life experiences.

My passion for public health and dental hygiene has created an advocate in me. It is a privilege to guide the next generation who will advance the field of health care. It is an honor to be a part of someone's personal and professional growth as I have so much respect for one who is willing to take a risk and follow their dreams of higher education. With a focus on the diversity of health care career paths, I aspire to pass along my passion and optimism for a satisfying, life-long career that makes a difference for others.

The Tooth Fairies 2 School-Based Oral Health Program **May 2016—October 2019**
Co-Director and Dental Hygienist
The Tooth Fairies 2 is endorsed by the Pierce County Health Department and is currently partnering with 31 ECEAP Head start Programs and elementary schools in Western Washington. I regularly attended the Puget Sound Educational Services District Health Advisory Committee meetings to help facilitate health care within the educational system. I designed training modules for dental hygienists contracted with us and coordinated schedules for school visits. I also provided oral health assessments, fluoride varnish applications, and oral health education for children.

Cornerstone Dental Hygiene Services, LLC **August 2015—June 2019**

Owner, Dental Hygienist

Provide portable palliative dental hygiene care for elderly patients in long term care facilities, including scaling and root planing, prophylaxis, extra- and intra-oral assessments and periodontal charting, fluoride varnish and silver diamine fluoride applications; Patient education; Coordinate referrals for patients in need; Provide oral health resources to the staff of long-term care facilities and caregivers. Perform all phases of business management and administration including formation, licensure, financing, and marketing; Responsible for ordering and maintaining supplies; Sterilization procedures; Maintain scheduling and recall schedule; Health history consultations with primary care physicians.

David L. Baird, DDS **January 2016–January 2018**

Lead Dental Hygienist

Manage clinic schedule for hygiene department, maintain clinic records and recall for hygiene patients; Created documents for clinic efficiency; Generate and manage marketing resources via digital communications, including the development and maintenance of social media profiles and creating posts related to dentistry. Perform all phases of dental hygiene for patients of all ages as described by the Dental Hygiene Practice Act of Washington; built patient rapport, taught oral hygiene care and explained surgical procedures and complex treatment plans.

Bellevue Specialized Dental Care, David Aronowitz DDS, MSD **2009—2016**

Lead Dental Hygienist

Perform all phases of dental hygiene for patients of all ages as described by the Dental Hygiene Practice Act of Washington State including; consistently built patient rapport by calming nervous patients, teaching oral hygiene care and explaining surgical procedures and complex treatment plans; Familiar with Dentrix software.

Dental Fears Research Clinic, University of Washington (UW) **2006—2007**

Patient Care Coordinator

Manage clinic schedule for multiple providers; Maintain clinic records, recall schedule for hygienists, patient treatment and charts; Prepare documents for weekly staff meetings; Triage requests for emergency dental care; Coordinate implant procedures between periodontists and restorative dentists; Responsible for cash security and deposit reconciliation.

Regional Clinical Dental Research Center, UW **2003—2006**

Dental Assistant II

Duties similar to that of a study coordinator including: develop and implement recruitment strategies and advertisement fliers, newspaper ads, etc.; Screen prospective subjects; Gather and record study data including clinical photography, saliva and plaque samples; Manage study schedules, study supplies, including interventions and control medications and devices; Maintain study records and database; Provide support for Human Subjects applications and modifications; Coordinate study team meetings; Develop data collection forms. Chairside assisting, patient education, clinical maintenance, and sterilization.

Tres C. Reeves III DDS, MSD, Scottsdale, AZ **June 2001—September 2003**

Surgical Assistant, Implant Coordinator

Chairside assisting of oral and IV conscious sedation procedures in a periodontal practice; Liaison for referral dentists during restorative phase of implant treatment; Intermediate removable partial ovate Pontic manipulation to achieve guided tissue healing; Create provisionals for implants; Clinical photography; Marketing of practice; Ordering and maintaining supplies.

Robert C. Janisse, DDS, Phoenix AZ **September 1997—June 2001**

Dental Assistant

Expanded function chairside assisting including: taking impressions, fabrication of study models, retraction cord placement, acrylic provisionals; Expose and develop radiographs; Expose and scan Denoptix digital imaging; Maintain Kreativ air abrasion unit and Cerac porcelain mill; Proficient with Eaglesoft and CAESY Patient Education System; Sterilization procedures, and ordering and maintaining supplies.

TEACHING EXPERIENCE

Lake Washington Institute of Technology **September 2018—Present**

Dental Hygiene Program

Research I: This introductory course familiarizes students with the basic foundation of research, research methodologies, research design, and evidence-based decision making. Principles of research are examined as a basis for the analysis and critique of professional literature. Students are introduced to concepts of research-based dental hygiene practice. This course teaches to the LWTech's Global Outcome of Information Literacy.

Research II: This course builds on DHYG 248 Dental Hygiene Research I. Students will apply the basic principles of research and develop analytical skills for evaluation of professional research.

Professional Practicum I & II: These courses introduces essential skills required to pursue alternative career paths and includes the preparation of a professional development plan and introduction of a capstone project and professional portfolio.

Senior Capstone and Portfolio: This course incorporates major learning themes of the student's dental hygiene education resulting in a student-generated capstone and portfolio. The capstone and portfolio will encompass the highlights of the student's research and major projects. Demonstration of the dental hygiene program learning outcomes is achieved through experiential learning, self-analysis, and strategies for completion and presentation of a capstone project and portfolio.

Radiographic Interpretation (Lab): This course builds on the scientific foundation established in DHYG 256. The focus along the health-disease continuum shifts toward basic concepts of disease at the cellular and clinical level. Students take radiographs on clinical clients and study the interpretation of radiographs to assist with formulation of the dental hygiene diagnosis.

Community Dental Health III (Lab): This course builds on the scientific foundation established in DHYG 256. The focus along the health-disease continuum shifts toward basic concepts of disease at the cellular and clinical level. Students take radiographs on clinical clients and study the interpretation of radiographs to assist with formulation of the dental hygiene diagnosis.

Dental Hygiene Theory and Practice IV-VII: Concepts of dental hygiene practice are presented. The emphasis is on dental hygiene assessment, diagnosis, planning, implementation, evaluation, and documentation. Skills and procedures are practiced by the student in clinic and laboratory environments on mannequins, peers, and clients.

Eastern Washington University **Spring Semester, 2018**

College of Health Sciences and Public Health

HSCI 402S: Current Issues in the Health Arena: I developed this course for the purpose of an administrative and teaching practicum. Content of the course addresses the changing health environment and identifies current topics on an annual basis for a particular focus. The course identifies 15 topics, each of which are examined for one week. Topics addressed include such issues as: Health Equity; Climate Change; Access to Health Services; Telemedicine; Our Aging Population; Marijuana, Cannabidiol, Early Childhood Caries, Silver Diamine Fluoride, Vaccinations; Acute Flaccid Myelitis; E-cigarettes, Violence, Mental Health; and Self-Care for the Health Science Student.

RECENT PROFESSIONAL DEVELOPMENT

Safe to speak: Fostering a psychologically safe teaching environment **March 2021**

ADEA Annual Session and Exhibition

We can change: Rethinking e-Portfolios in assessing student competency **March 2021**

ADEA Annual Session and Exhibition

Writing the accreditation self-study: Consider it handled! **March 2021**

ADEA Annual Session and Exhibition

Leadership Summit **January 2021**

ADHA

Open Education Conference **November 2020**

PRESENTATION EXPERIENCE

Independent Practice for the Dental Hygienist **Spring 2019**

Greater Seattle and Snohomish County Components Graduate Dinner, Keynote speaker

I shared my experience of independent practice with graduating dental hygiene students and component members. Special considerations for senior-focused practice and school-based oral health programs discussed, including reimbursement pathways. Emphasis on increasing access to care in a public health setting and interprofessional collaboration was made.

School Sealant and Fluoride Varnish Endorsement Seminar **Spring 2019**

Pima Medical Institute Dental Hygiene Program

Seattle Central Community College Dental Hygiene Program

Lake Washington Institute of Technology Dental Hygiene Program

Created and provided the learning unit for the School Sealant and Fluoride Varnish endorsement. This learning unit is evidence-based using Smile Survey data, King County census data, and shared experience from my participation in a school-based sealant program.

Independent Practice for the Dental Hygienist **August 13, 2018**

Lake Washington Institute of Technology Dental Hygiene Program

Shoreline Community College Dental Hygiene Program

As part of an interview panel with varying career pathways represented, I shared my experience of business formation and implementation. Special considerations for senior-focused practice and school-based oral health programs discussed with a focus on the dental hygiene Revised Codes of Washington.

Oral Health for the Elderly **April 5 and 10, 2018**

A seminar on inter professional collaboration

Lake Washington Institute of Technology Nursing Program

Lake Washington Institute of Technology Dental Hygiene Program

Discussed how to recognize characteristics of, and when to refer for, common oral health issues of the elderly including denture stomatitis, oral candidiasis, oral cancer, xerostomia, periodontal disease, and dental caries; Encouraged inter-professional collaboration by teaching oral hygiene with standard and modified oral hygiene aids for patients with mental and physical disabilities.

Oral Health for Early Preschoolers **2014, 2018**

Bright Horizons Early Childhood Learning Center, West Campus

Bellevue, Washington

- Classroom visit for 3-year olds: Sang songs regarding brushing teeth to prevent cavities, discussed healthy foods for teeth, and used dental puppet with oversized toothbrush for dramatic play.

- Classroom visit for 12 to 18 month old toddlers and parents: Sang songs regarding brushing teeth to prevent cavities, discussed healthy foods for teeth, and used dental puppet with oversized toothbrush for dramatic play; Question and Answer with parents about tooth eruption patterns, first dental appointments, oral hygiene for toddlers, how to recognize "white spot lesions", and the benefits of fluoride.

Common Oral Health Issues of the Elderly in Long-Term Care Facilities January 2016
Issaquah Nursing and Rehabilitation Center
Discussed how to recognize characteristics of, and when to refer for, common oral health issues of the elderly including denture stomatitis, oral candidiasis, oral cancer, xerostomia, periodontal disease, and dental caries.

PROFESSIONAL ASSOCIATIONS

National Society of Leadership and Success	2017—Present
Alliance of Dental Hygiene Practitioners	2015—Present
American Dental Education Association	2015—Present
American Dental Hygienists' Association	2009—Present
Washington State Dental Hygienists' Association	2009—Present
Phi Theta Kappa International Honor Society	2006—Present

COMMUNITY SERVICE

Smiles Forever non-profit organization volunteer in Cochabamba, Bolivia	2018
Smiles Forever board member	2018-2019
Tacoma-Pierce County Oral Health Coalition member	2017-2019
Puget Sound Educational Services District Health Advisory Committee member	2017-2019
Seattle/King County Clinic dental hygiene services provider	2015, 2016
Organized community food and clothing drive for Oso, WA landslide survivors	April 2014
Parent volunteer for Issaquah Dance Theatre	2014, 2016, 2018, 2019

HONORS AND AWARDS

Senior Class President, Dental Hygiene Program, Lake Washington Institute of Technology

Future Leader Award, Washington State Dental Hygienists' Association

Princeton L. Co Scholarship, Lake Washington Institute of Technology

Sandy Daw Award, Lake Washington Dental Hygiene Society

Student delegate and page, House of Delegates, Washington State Dental Hygienists' Association

Student alternate delegate, House of Delegates, Washington State Dental Hygienists' Assoc.

RELATED RESEARCH EXPERIENCE, UNIVERSITY OF WASHINGTON

- One Year Clinical Assessment of Clinpro™ Sealant Placed with either Self-Etching Adhesive or Conventional Acid Conditioning; Principal Investigator: Joel Berg, DDS, MS
- Xylitol Clinical Studies for Prevention; Principal Investigator: Peter Milgrom, DDS
    - Gum Study (Project #1)
    - Gum Study (Project #2)
    - Gum Study (Project #3)
    - Bioavailability of Xylitol-Containing Products
    - Gummy Bear Study (Project #4)
- Trial of Oramelts with Licorice Root Extract for Treatment of Minor RAU; Principal Investigator: Jeffery J. Sherman, PhD
- Development of a Methodology to Evaluate Interproximal Plaque; Principal Investigator: Roy Page, DDS, PhD
- Comparison of the Effect of a Prototype Toothbrushing System and a Manual Toothbrush on Supragingival Plaque; Principal Investigator: Roy Page, DDS, PhD
- Cognitive Interventions in Pediatric Dentistry; Principal Investigator: Peter Milgrom, DDS
- Mechanisms for Racial Disparity in Preterm Birth; Principal Investigator: Jane Hitti, MD, MPH
- DNA Microarrays: Detecting Microbes in Oral Cavity Fluids; Principal Investigator: David Stahl, PhD
    - Microarray Diagnostics Study (Project #2)
- Hormonal Cycles in Women: Effects on TMD Pain & Symptoms; Principal Investigator: Linda LeResche, PhD
    - Study 1: Relationships of Pain and Stress to Estradiol Levels Across the Menstrual Cycle

- Study 2: Targeting Self-Management of TMD to Changes Across the Menstrual Cycle

PUBLICATIONS

Sherman, PhD, Jeffery J., Roland Barach, PhD, Kellie K Whitcomb, CDA, Jeffrey Haley, BA, BS, JD, and Michael D. Martin DMD, PhD. "Pain and Pain-Related Interference Associated with Recurrent Aphthous Ulcers." Journal of Orofacial Pain 21 (2007): 99-106.

Duffin et al. (2019). *SMART Oral Health: The Medical Management of Caries.*

REFERENCES

Cindy Ko, RDH, MEd
Associate Dean of Dental Programs, LWTech
Number available upon request

Marilynn Rothen RDH, MS
Washington Dental Hygienists' Association Past President, Mentor
Number available upon request

Carrie Gandhi, DDS
Lake Washington Institute of Technology, Dental Hygiene Program
Number available upon request

Sharon Golightly, EdD, MS
Pierce College, Professor Emeriti and Director, Dental Hygiene Program
Number available upon request