

**IDT601 (Instructional Analysis I):**

**Instructional Design Front End Analysis (IDFEA)**

Submitted in partial fulfillment of the requirements for the degree of  
Master of Science in Instructional Design and Technology (MSIDT)

By

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To

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### **Problem Description**

The following addresses development of effective skills and techniques for taking dental radiographs using proper positioning of the digital sensor to improve assessment and diagnosis of pathology. Learning to take dental x-rays in the dog and cat has a steeper learning curve than when learning to take them on people due to differences in oral anatomy. Training staff to take dental x-rays is currently being taught in four-hour wet labs or as in-clinic training. The goal of the training is to teach the participants enough positioning skills to be able to take dental radiographs. The trainings are always face-to-face and hands-on. The positioning technique is demonstrated, and then each participant repeats the demonstration before we move on to the next position.

The training addresses the following three conditions:

1. How the angle of the x-ray machine affects the length of the tooth.
2. The participants view an image with proper positioning which demonstrates a typical appearance of a tooth.
3. The participant needs to evaluate their results and determine how to improve the angle of the tube head and the location would improve the image.

Participants have issues with positioning and technique at every training, specifically number one and three from the above list.

### **Data Collection**

A survey was posted to the Academy of Veterinary Dental Technician email server and Facebook page. Respondents answered the following questions:

1. Do you have difficulties teaching dental x-ray positioning?
2. What are the top three problems your trainees encounter when positioning the x-ray machine?

### **Respondent 1 Results**

The first respondent teaches dentistry for a Veterinary Technology program and provides training at local clinics.

The respondent identified students with difficulty understanding that dental procedures contribute significantly to the health care of dogs and cats. In clinical experience, he found they had the necessary skills, but were not able to consistently image specific areas of the mouth. Both groups had difficulty understanding how the angulation of the beam affects the angle of the tooth. Lastly, there were problems understanding how to make corrections to angulation problems and cutting off parts of the image.

### **Respondent 2 Results**

The second respondent also teaches dentistry for a Veterinary Technology program and provides in-clinic training. This respondent is unique as she has macular degeneration which makes her legally blind and unable to drive. She provides her in-clinic training remotely to have a computer that provides visual enhancement while the staff members are in training. Her response to the questions focuses on her veterinary technology students.

Her students also find the subject matter uninteresting at times and are easily distracted. The students also have problems understanding the radiology terminology and how the length of the tooth is affected by the angulation of the beam. The other obstacle is the type of specimen

she is required to use. They must use skull models for teaching vs. a cadaver. Cadavers are better to work with since they have soft tissue to work with which is more realistic than a skull model. A skull model also has teeth and bones, but the jaws are not articulated which makes the jaw difficult to manipulate.

### **Respondent 3 Results**

The third respondent works in veterinary practice with a doctor who is in a residency to become a veterinary dentist. She takes radiographs of patients in her practice and teaches dental radiology in both wet labs and clinics.

Her participants had difficulty grasping the concept of the length of the tooth image is affected by the angulation of the tube head. She also has students that will cut off part of the image due to improper placement of the sensor under the tooth being radiographed. The last difficulty her participants face is an inability to correct the positioning error by looking at the image and comparing that to the current position of the tube head and the sensor plate.

### **Respondent 4 Results**

The fourth respondent is an independent contractor that teaches and trains dental skills and dental radiology.

The respondent found students have difficulty with the concept the tooth length being affected by tube angulation. Also, errors due to the sensor plate being incorrectly placed in relation to the tube head was an issue. This respondent also mentioned some of her respondents were frustrated with the amount of time it takes to acquire a set of full-mouth x-rays. This last issue is restricted to those participants that have experience working with patients in their clinic.

## **Respondent 5 Results**

Respondent 5 is a veterinary nurse that works in a veterinary school. She provides training mostly to her veterinary students but also does some in-clinic and wet lab training in dental radiology positioning.

She noted that the most common issue among her participants and students was the inability to place the digital sensor entirely under the required tooth. She also found that her students/participants were flustered that taking dental x-rays were not as intuitive as taking full body x-rays. The fact that the learner had to think through the positioning process with a 50/50 possibility of failure increased the anxiety. The increased tension was due to the process taking longer than they imagined.

### **Needs Analysis**

The purpose of the training needs analysis is to identify if there are further training needs required to improve the performance of the employee. A training gap in the survey responses, causes learners to be less successful in their first training and when they apply their newly learned skills.

#### **Problem Need Part 1: Correct placement of the sensor to radiograph the intended tooth.**

Justification: As noted in the questionnaires, this issue affects not only students or participants who are new to taking dental radiographs but is also found to continue when they are back in their work environment. The difficulty may be the result of inadequate knowledge of anatomy or lack of attention during the demonstration. Challenges with this step can affect the success and lead to Problem Need Part 2.

**Problem Need Part 2: Correct angulation of the tube head to avoid elongation and foreshortening of the tooth image.**

With full body x-rays of dogs and cats, the film is placed underneath the examined part of the body. The tube head used in full body radiographs is commonly set at 90 degrees. If that body part is on top of the film and the beam is aimed at the body part, you will successfully image the body part.

In dental radiography of the dog and cat, the anatomy of the oral cavity does not allow you to place the film or digital sensor directly behind the entire tooth. The film or sensor must be angled to cover the body of the tooth entirely. Because of this angled film or sensor, the learner must change the angle of the beam to construct an image that is the actual size of the tooth. In veterinary textbooks that cover dental radiology, finding the correct angle for the tube head is called bisecting angle technique. In short, the long axis of the tooth and the plane of the film form an angle that is bisected. The tube head is lined up so that it is perpendicular to the bisection line (DuPont, 2009). The visualization and attempts at this technique can be very difficult for many that are weak in math skills. It can only be understood with hands-on training.

After discovering learners did not understand the bisecting angle technique, a technique was simplified. The x-ray beam is compared to sunlight. Sunlight, when it hits an object, casts a shadow and depending on the time of day, that shadow is longer than the object (at sunset), the shadow is the same length as the tooth (around 2:00-3:00 pm), or too short (at noon). The tube head at 90 degrees mimics noontime which would make the image too short. The tube head at 35 degrees simulates sunset which would make the image too long. The tube head at around 45 -

50 degrees which simulates 2:00-3:00 pm should make the length of the image the correct length. The challenge is translating this simplified concept to hands-on training and subsequent mastery.

### **Learner Analysis**

The purpose of the learner analysis is to ascertain the learning level of the of the individuals that will participate in the training (Cheung, 2016). The results will shape the components of the instructional goals. During the analysis phase, information is collected about the current knowledge and abilities of the participant and what the participant needs to acquire the intended skill. The learner analysis needs to be examined early in the planning process. The information that is gathered is helpful as design decisions are made (Morrison, 2012).

Six participants were surveyed and interviewed as a group before the start of dental skills and radiology training held at a veterinary clinic. The survey was built and shared through an online survey program (See Appendix A). The survey results were attached with the assignment submission.

### **Characteristics of Target Population**

Analyzing the characteristics of your target population involves investigation of general participant demographics by age, physical limitations and gender, what motivates learning, their work, cultural and political environment. Secondly, getting information on what the learner already knows about the intended training topic. Handshaw (2014) noted that analysis on both the target population and the current level of knowledge will affect the choice of content and how one will design how the content will be best used for the training. The analysis helps the designer to fit the learner's needs.

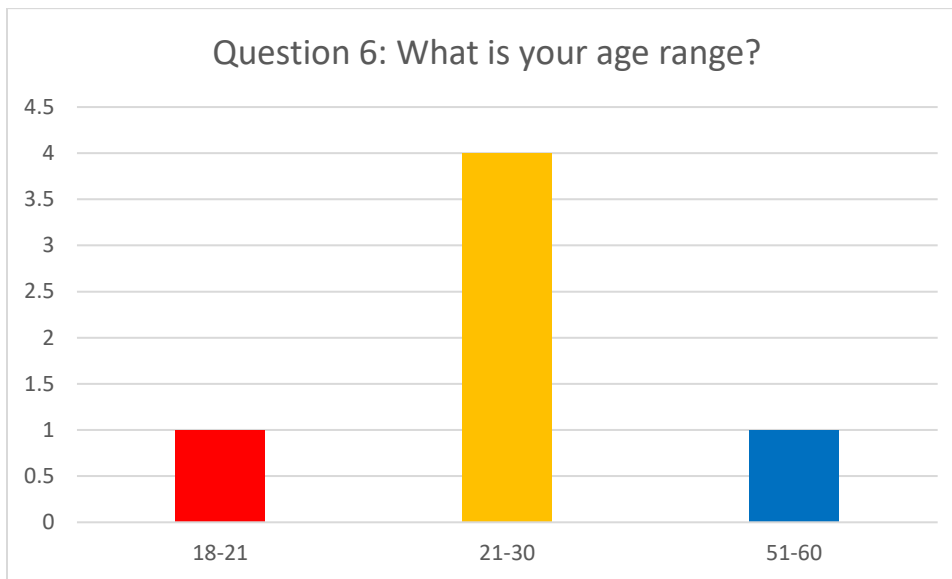


### ***Generational/Age Characteristics***

Four of the six participants were in the 21-30-year-old range. One participant was 18-21 years-of-age, and one was 51-60 years-of-age (See Table 1).

Table 1

#### *Survey Results: Age*



Renee Allen at the West Midland Family Center (2019) provides a chart on generational differences. According to the way generations are divided by birth year, the participants represent Baby Boomers, Generation-X, and Millennials. Baby Boomers are interested in personal growth and do well in a team environment. Boomers have a good work ethic and can perform under pressure. Technology was not a part of the Boomer upbringing, so any technology training must be done in a hands-on environment and require explicit instruction.

Generation-X tends to be more independent which can cause them to be less committed to an organization but interestingly are loyal to brand names. Generation-X are self-starters and

technology literate. In this training circumstance, they learn the software quickly and can tailor the software to work best in their clinic setting. Generation-X spearhead the forward momentum of many veterinary practices into the digital age.

Millennials, sometimes called Generation-Y are avid consumers and sociable to foster their need to belong. The sociability happens primarily on social media. They live in a world with 24/7 access. Millennials are eager to learn but become frustrated if the knowledge does not come quickly. When the skill is not swiftly learned they would sometimes not continue trying.

### ***Gender Characteristics***

Staffing at veterinary clinics is primarily female. Data shows women at 91.7% (Veterinary technician & veterinary assistant, 2015). The training survey included five women and one man. Male participation is rare. Women learners in dental radiology require the trainer to keep the participants engaged and focused. In the clinic setting, some distractions can cause the participant to divert their attention during the demonstrations which cause them to have difficulty when it is their turn to repeat the process. According to Bonnot and Krauth-Gruber (2016), most male participants tend to do better repeating the positioning due to their ability to visualize how the angles work.

### ***Motivational Characteristics***

Veterinary clinics tend to hire people that are not medically trained and train them in-house. Unfortunately, there is no statistical data to support this statement other than interviewing staff members for the last 11 years. Hiring people with few medical skills means they can be paid less than a medically trained veterinary nurse.

Clinic trained staff are not required to obtain continuing education to maintain licensure since they are not licensed. Any training or skills needed for the job are provided by the clinic. If a training is required, attendance is mandatory. If the staff member is interested in the training, motivation is high, and if they are not interested in the training content or an employee only interested in the paycheck, motivation can be low. High motivation can also be seen if completion of the training improves their standing in the clinic.

Medically trained nurses can experience the same variances of motivation. If the nurse assisted in the decision to purchase a piece of equipment or rallied the clinic to make improvements to the clinic, motivation is high. Sometimes nurses who feel they have accomplished the skills needed for the upcoming training will feel it is a waste of time.

The variable levels of motivation need to be recognized with either by interview or survey. Occasionally, motivation levels aren't visible until the day of the training. To overcome low motivation in a training situation is engaging the learner as quickly as possible with multi-sensory training and maintaining participant focus. Keeping participant focus can increase energy, which can increase enthusiasm for learning.

### **Environmental Characteristics**

Entry characteristics focus more closely on the environment surrounding the participant that can influence learning. Morrison, Ross, Kalman, and Kemp (2012) explained that having this amount of detail about the participant can impact their ability to achieve the learning goal. Knowing which characteristics would be most helpful to the design. These characteristics go

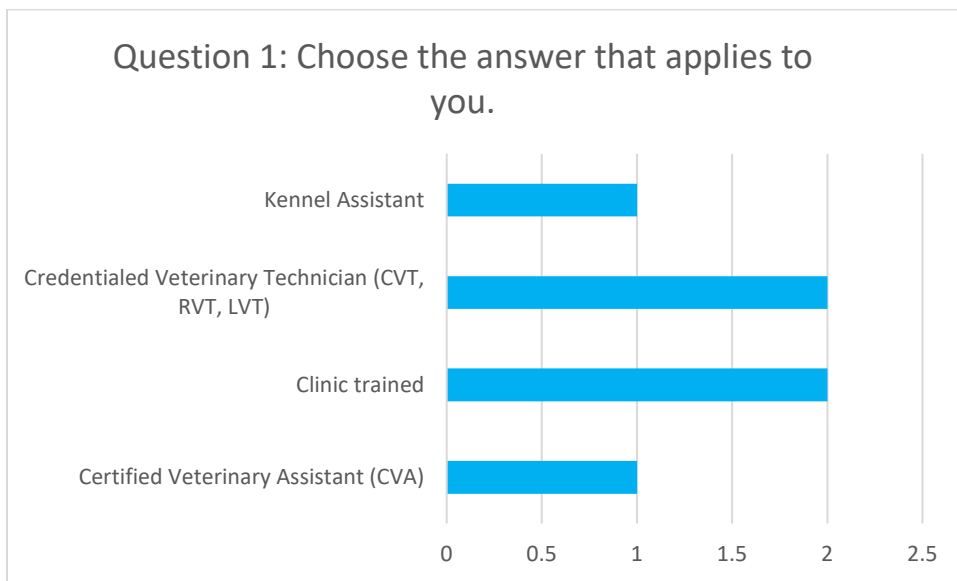
beyond general characteristics such as age and gender. Now we want to identify those participant characteristics that would help bring them success in the training.

***Physical Characteristics***

The physical characteristics of the group surveyed were 83% female and 17%, male. The presence of men in these trainings is rare. Most of the attendees were 31-40 years of age, and there was one attendee that was in the 51-60-year-old range and one attendee that was 18-21 years of age. No physical limitations were present that would impede learning. Two of the attendees were credentialed veterinary nurses, and one was a certified veterinary assistant. Two were clinic trained, and one was a kennel assistant (See Table 2).

Table 2

*Survey Results: Groupings by Job Title*



The attendees that were credentialed veterinary nurses had dentistry experience. One attendee had dentistry experience through on-the-job training; the rest had no experience working with dental cases. Varying levels of experience require setting aside some time to provide skills to those who have no experience to catch them up with the rest of the group. Bringing everyone up to speed can cause experienced attendees to become bored or distracted.

### ***Social Characteristics***

Group trainings can lead to competitive behavior. Participants expect success on their first try taking dental radiographs. Duckworth (2016) found that when the attempt is not successful, the participant can feel like a failure, but sometimes the failure inspires them to adjust and be successful the next time.

When teaching radiograph positioning, it is best to prepare the participants that success does not happen every time. What happens with practice is the ability to see the mistakes and fix them with fewer retakes. The first round of taking radiographs is historically the slowest as everyone walks through it. Timing participants might bring some interesting data to prove this theory. As they continue through the training, the process speeds up.

Clinical training is an excellent opportunity to promote group interactions. The participants support each other through the training process with the hope that it will continue through the future. The participant has better success if they are not working on the problem alone. The opportunity to learn from others comes from sharing knowledge and collaborating with others.

### *Political Characteristics*

Table 3 shows the hierarchy in the veterinary clinic which impacts the political characteristics of the medical and support staff.

Table 3

#### *The hierarchy of the veterinary clinic*



Sometimes the doctor can be the owner of the practice and is in charge of medical and financial decisions. Practice managers are mostly in charge of the staff and handle the management of the front desk. Surgical/nursing staff and below answer to either the doctor or the practice manager. The doctor would decide training would be a good idea, and the practice manager discusses the training with the staff, and they choose when the training should take place. The practice manager schedules the training and is in charge of corresponding with the trainer and makes other preparation such as blocking out the schedule for the training and ordering meals.

The staff is expected to be present at the training or notify in advance. The staff members attending the training may not be paid. Mandatory attendance and lack of earning can negatively affect motivation for the training. It is a better idea to choose the staff members who would benefit most from the training and make it mandatory for them. If other staff members wish to attend, they must inform the practice manager. Setting outcome goals and feedback in the design phase of the training would be beneficial for the practice manager and the doctor if they are not planned to be in attendance. The feedback and outcome goals would help the managerial staff interact with the staff after the training and allow the participants to share their experiences.

### *Cultural Characteristics*

The culture of the veterinary clinic can vary widely. Some clinics only require staff to come to work, and some clinics want to make the success of the veterinary clinic a joint effort involving all staff.

When a clinic decides to pull everyone in to make the clinic successful, staff members are asked to set goals or enter a clinic contest. The results of participating are recognition from the staff and pet owners and compensation. There can also be pay raises if a member of the team has worked a set period. Recognition and reward stimulate the clinic or the individual to participate which can raise motivation and comradery. Clinics can also provide benefits in the form of paid continuing education. Sometimes the staff member must present a report about their experience or a medical topic they found interesting.

Alternately, staff members will seek out continuing education classes and set their own goals. Self-starter goals are a great way to avoid burnout or compassion fatigue. Many online CE program sites offer free continuing education classes (Free courses, n.d.).

The participant's enthusiasm to be present at the training depends on interest, management request or receipt of recognition or compensation. Obtaining this knowledge from the practice manager would impact the atmosphere of the training for others. The design would need to have components that could foster interaction among participants to elevate motivation.

### **Subordinate and Prerequisite Skills and Knowledge**

The subordinate and prerequisite skills show the knowledge that is required by the participant before and after the training. Based on the survey and needs analysis, the required skills are listed below.

1. Recognize and locate the four types of teeth in the oral cavity of the dog and cat.
2. Charting the oral cavity utilizing the Modified Triadan Numbering system
3. Basic computer skills covering commands used in word processing.
4. Radiation safety and regulations as it applies to your state.

### **Scope**

The goal of the instruction is to train veterinary medical and surgical staff to take digital dental radiographs of the dog and cat.

### **Task Analysis**

- I. Describe the oral anatomy of the dog and cat.**



- A. The ability to identify structures of the oral cavity in the dog and cat is necessary to learn proper placement of the sensor or plate.

## **II. Identify components of the dental x-ray generator.**

- A. Most participants have experience operating the settings on a full-body x-ray unit. Adjustments to the kVp, mA and time change the contrast and density of an image and improve the quality.
- B. Participants must know how to operate the settings on the dental x-ray generator. The trainer must show the participants how to operate the settings.

## **III. Describe dental x-ray safety procedures.**

Radiation exposure is a hazard in veterinary practices. The use of personal protective equipment (PPE) is required when performing full-body radiographs (Partington, 2006).

- A. All participants need to review radiation safety.
- B. Participants must stand 6 feet away from the x-ray generator and opposite the path of the primary beam (Dupont, 2009).
- C. Areas covered are PPE, the use of dosimetry monitors, and recommendations in the event of pregnancy.

## **IV. Determine sensor placement and tube head angulation and describe the effect on image length in the finished image.**

- A. Identification and recognition of the standard location of the four types of dog and cat teeth is a required prerequisite skill.
- B. The sensor or plate must be put under or behind the intended tooth or teeth which requires the tube head to be angled to produce a tooth image that is the correct length.

The right image length is approximately the same length as the tooth itself (DuPont, 2009).

#### **V. Evaluate the finished image on the computer.**

The image appears on the computer screen either as a single image or in a predefined slot in a template called a film mount. Once the image has appeared it is assessed using the following criteria.

- A. The image appears in the appropriate location on the screen. If the image appears in a film mount, it must be in the proper place and the appropriate position.
- B. Is the image high quality? The participant must identify what constitutes a high-quality image?
- C. Teaching the participant how to evaluate a finished image improves their troubleshooting skills to improve the quality of the image.

#### **VI. Utilize appropriate software training**

- A. Participants must learn the basic commands to run the software, make annotations to the image and become familiar with preparing a patient report.

### **Instructional Analysis**

The instructional interventions that will likely be effective for addressing the identified performance problems along with the target population and task analyses are listed below:

- Oral and dental anatomy of the dog and cat.
- The Modified Triadan Numbering System.
- General radiology principles.

- Dental x-ray generators.
- Dental radiograph digital equipment and software.
- Dental radiograph positioning techniques.
- Dental radiographic anatomy.
- State laws about x-ray safety and inspection requirements.

### **Content**

The scope of the required content as determined from the needs assessment findings can be gained from the following sources:

1. Veterinary textbooks by board-certified veterinary dentists or veterinary technician specialists in dentistry. Most books have a section on the dental radiographic equipment, basic techniques, and dental anatomy.
2. Veterinary radiology textbooks by board-certified dentists or veterinary technician specialists in dentistry. These books cover dental radiographic technique, positioning, and equipment in greater detail.
3. Dental x-ray equipment and any software information can be found through the manufacturer. Manufacturer websites can also be an excellent source of information in multimedia formats such as graphics and product videos (Digital Dental X-Ray, 2018).
4. Observation can provide insights on the skills necessary to master. Observation occurs place at in-clinic trainings or a wet lab setting.
5. Identify state regulatory laws and inspection information.

## **Goal Sequence**

### **1.0 The oral anatomy of the dog and cat.**

1.1 Identifying oral anatomy structures is necessary to learn dental radiography.

1.2 Recognizing the oral anatomy of the dog and cat ensures correct placement of the sensor or plate.

### **2.0 Components of the dental x-ray generator.**

2.1 Review generator settings before taking the first image. The manufacturer's instructions come with suggested baseline settings for each type of tooth.

2.2 Manipulation of the tube head to adjust the angle using the attached protractor before taking the image.

### **3.0 Practice proper dental x-ray safety techniques.**

3.1 Dental x-ray safety is critical knowledge before a dental radiograph is ever produced.

Not practicing dental x-ray safety presents an unnecessary risk to both the operator and other staff members in the clinic.

3.2 Review of state regulations will be helpful to handle any questions.

### **4.0 How sensor placement and tube head angulation can affect the length of the tooth.**

4.1 Review the correlation between how and where the sensor is placed and the angle of the tube head.

4.2 Recognizing the correlation can lead to better outcomes once the training begins.

### **5.0 Evaluate the finished image on the computer.**

5.1 Identification of normal dental anatomy helps the participant identify abnormalities.

5.2 Describing the radiographic anatomy of a healthy tooth will help the participant recognize radiographic pathology.

5.3 Recognize the difference between a high and poor-quality image.

5.3.1 Presented with a well-executed radiograph, the participant will learn to recognize a problem exists.

5.3.2 Recognizing radiographic technical flaws and identifying the cause will reduce the need for retakes.

5.3.3 Learning the steps needed to make corrections will also reduce the needs for retakes eliminating guessing at a solution

## **6.0 Software training**

6.1 The addition of software for digital dental systems requires software training.

6.1.1 How to enter a patient into the system.

6.1.2 How to acquire an image

6.1.3 How to annotate an image

6.1.4 How to use the software to write and maintain dental x-ray records.

## **Stakeholder Feedback**

### **Validation**

Subject Matter Expert (SME) #1 has her Doctor of Education, has authored textbooks and is currently a program chair of a Veterinary Technology program in Georgia. SME # 2 is an instructor of veterinary technology with years of experience teaching dental skills. SME#3 is a practicing Veterinary Technician Specialist in both dentistry and anesthesia/pain management.

**Feedback**

Feedback was obtained from the three SMEs. Each SME was sent a copy of the Instructional Design Front End Analysis (IDFEA) with feedback questions. The SMEs made revisions to the document and answered the feedback questions on a separate document (see Appendix B). Table 3 is a summary of the SME feedback.

Table 3

*SME Feedback Summary*

|   |   |
|---|---|
| <p><b>Subordinate and prerequisite skills and knowledge</b></p> | <ol style="list-style-type: none"> <li>1. Skill #2 regarding charting using the Modified Triadan System needs further explanation of its purpose as a required skill.</li> <li>2. Add knowledge of radiation safety, state laws and regulations.</li> <li>3. Add a review of basic computer skills i.e. copying and pasting, click and drag.</li> <li>4. Add a review of Personal Protection Equipment (PPE) needed for radiographic studies</li> </ol> |
| <p><b>Task Analysis</b></p>                                     | <ol style="list-style-type: none"> <li>1. This section had mostly positive feedback. Some suggested wording revisions were beneficial to the piece.</li> </ol>  |

|                      |   |
|----------------------|---|
|                      | The revisions have been made to this document.  |
| <b>Goal Sequence</b> | <ol style="list-style-type: none"> <li>1. Move the software training earlier in the training so the participant can practice using the software while the training is ongoing.</li> <li>2. Sequence #4 is key to the participant's future success and needs to be heavily focused on. If done well, it could decrease time spent on sequence #5.</li> </ol> |

### **Materials**

Two types of materials will be chosen for the training. The first type of materials should cover information and instructions. These materials will help the participant to navigate through the course easily. The second type of materials should provide active, engaged learning and feedback. Both types of materials should not be presented concurrently since this will overwhelm the participant. Instead, the types of material will be chosen based on the tasks listed in the goal sequence section. In some cases, the task will require both the first and second type.

### **Content Analysis**

The content of the course should first allow the participant to quickly navigate through each of the steps in the goal sequence. Secondly, the content should provide active learning to build the

confidence of the participant. Building participant confidence will assure better retention of the skill and assure the passing of the skill to the participant’s clinic environment (Handshaw, Designing for the classroom -virtual and live, 2014). The content will also have assessments at pre-determined points throughout the training. Assessments will be given at the end of each unit to ensure the material was completed. Assessments will be set up to be repeated to allow the participant to improve results as needed.

The course is divided into three sections: pre-training, active training, and post-training. Pre-training materials will be reviewed and completed by the participant before the active training session. Active training materials will be reviewed and completed during the face-to-face portion between the participant and the trainer. Post-training materials will be reviewed and completed immediately after the active training.

**Pre-training session.**

The pre-training will be held online. A course will be designed to prepare the participants for the future active learning session. The pre-training session will cover prerequisite skills and knowledge 1-3 found on page 15. The designer will have all the pre-training materials prepared for building the course site. Table 4 includes the suggested content for the pre-training session.

Table 4

*Content Analysis: Pre-training Session*

| Training milestones | Materials considered |
|---------------------|----------------------|
|---------------------|----------------------|



|  |   |
|--|---|
| Introduction   | <ul style="list-style-type: none"><li>• Welcome page upon entering the course.</li><li>• Pre-recorded video welcome from the instructor.</li></ul>  |
| Instructions for navigation through the pre-training materials and the course      | <ul style="list-style-type: none"><li>• Written goal statement for the course.</li><li>• Written and downloadable instructions for navigating around the course site.</li><li>• Written and downloadable instructions explaining the course layout.</li><li>• The homepage should have links to all aspects of the course to allow the participant access right away.</li></ul> |
| Map out units and lessons for pre-training course                                  | <ul style="list-style-type: none"><li>• The units and lessons of the pre-training course will be mapped out using concept mapping software.</li></ul>   |
| List objectives, instructions, the chosen materials and assessments for each unit. | <ul style="list-style-type: none"><li>• Written introduction to each unit.</li></ul>  |

|  |  |
|--|--|
| <p>Unit 1: Recognize and locate the four types of teeth in the oral cavity of the dog and cat.</p> <p>Unit 2: Charting the oral cavity using the Modified Triadan Numbering System.</p> <p>Unit 3: Review basic computer skills covering commands used in word processing.</p> | <ul style="list-style-type: none"> <li>• The written outline is showing the name of the unit, the objective(s) of the unit, the course materials, and the planned assessment for the unit.</li> <li>• Assessments will be in the form of a quiz taken online.</li> <li>• Quiz questions will need to be written based on the course materials for the unit.</li> <li>• Questions must be easily referenced back to the course materials.</li> <li>• Questions will be forced answer or short answer.</li> <li>• Each question will require a feedback statement explaining the reasoning behind the correct answer.</li> </ul> |
| <p>Sublist the lessons, instructions for each unit.</p>  | <ul style="list-style-type: none"> <li>• Using the concept map, break each unit down into lessons and add them to the course outline.</li> <li>• Written introduction with instructions on how to navigate the lesson layout.</li> </ul>   |

|  |   |
|--|---|
| List objectives and materials for each lesson        | <ul style="list-style-type: none"> <li>• Written lesson objectives and course materials for each lesson.</li> </ul>   |
| Provide final assessment results to the participants | <ul style="list-style-type: none"> <li>• Participants final assessment results will be added to the assessment rubric. The rubric should have comments from the instructor covering the success of the student.</li> </ul>                                |
| Certificate of completion                            | <ul style="list-style-type: none"> <li>• Printable or downloadable certificate the participant will need to bring to the Active Training Session</li> </ul>   |
| Participant Survey                                   | <ul style="list-style-type: none"> <li>• Polling or survey software to allow the participants to provide feedback on their experience with the course.</li> <li>• The survey will include forced answer questions and an area to add comments.</li> </ul> |

### **Active Training Session**

The Active Training Session will provide skill building through interaction with course materials and the trainer. The session includes classroom/in-person instruction for topics 2-6 in the goal sequence. A manual will be distributed to the participants which divide the training into modules with activities attached to each module. Table 5 covers the content analysis for the active training session

Table 5

*Content Analysis: Active Training Session*

| Course Milestones              | Course Materials  |
|--------------------------------|---|
| Participant Manual             | The manual will be a bound document covering: <ul style="list-style-type: none"> <li>• Training agenda.</li> <li>• Training objectives.</li> <li>• Course modules with objectives</li> <li>• Activities that correspond with the module. Each activity will be listed in a step-by-step format</li> </ul> |
| Review of pre-training session | Group discussion - Recap and review of pre-training session and how they connect to the active learning session.  |

|  |   |
|--|---|
| <p>Module 1: Demonstrate dental x-ray generator settings.</p>    | <ul style="list-style-type: none"><li>• Written instructions including diagram or photograph pointing out the location of the settings buttons.</li><li>• Group orientation session is demonstrating how the settings are adjusted.</li></ul>   |
| <p>Module 2: Practice proper dental x-ray safety techniques.</p> | <ul style="list-style-type: none"><li>• Written instructions on dental x-ray safety.</li><li>• Group discussion is covering dental x-ray safety techniques.</li></ul>   |
| <p>Module 3: Sensor placement and tube head angulation.</p>      | <ul style="list-style-type: none"><li>• Group presentation covering the theory of the interaction between sensor placement and tube head angulation to produce a diagnostic radiograph.</li><li>• Cadaver specimens of a dog and cat head</li><li>• Dog and cat skulls, clear acrylic dog and cat mouth models.</li><li>• Written checklist of the steps to properly position the sensor for each x-ray view.</li></ul> |

|  |  |
|--|--|
|  | <ul style="list-style-type: none"> <li>• Written checklist of the steps to properly angle and align the tube head for each x-ray view.</li> <li>• Group demonstration by the trainer showing the steps to accurately position the sensor, angle the tube head and align the tube head for each view.</li> </ul>  |
| <p>Module 4: Evaluate the finished image</p> | <ul style="list-style-type: none"> <li>• Written checklist of the steps to assess the produced x-ray image.</li> <li>• Written list with graphics of common technical flaws with solutions.</li> <li>• A copy of a high-quality image with arrows pointing to features that demonstrate a high-quality image.</li> <li>• The image produced by the participant.</li> </ul> |
| <p>Module 5: Software training</p>           | <p>Written instructions covering:</p> <ul style="list-style-type: none"> <li>• How to enter a patient into the system.</li> <li>• How to acquire an image.</li> <li>• How to annotate an image.</li> </ul>   |

|  |   |
|--|---|
|  | <ul style="list-style-type: none"> <li>• How to operate the software to write and maintain dental x-ray records.</li> <li>• Group demonstration showing each of the above tasks.</li> </ul> |
|--|---|

**Post Training Session**

The post-training session will gather feedback from the participants. The survey results will then be compared with the feedback from the pre-training session and observations of the active session to make modifications to the course design. Table 6 covers the suggested content for the post-training session:

Table 6

*Content analysis: Post-training Session*

| Course Milestone | Materials Needed                                     |
|------------------|--|
| Exit Survey      | Written survey to be filled out by the participants. |

**Proposed Technology**

The important rule when choosing technology is to prepare the training first and then fit the technology to the training (Piskurich, 2015). The technology should be kept as simple as possible to avoid confusion on the part of the participant while they are in the course. The type of technology needed will depend on the phase of the course.

**Pre-training Session**

***Authoring system.*** The course will need to be written using an authoring system. The choice of the system will be based on its ease of use for the designer. The system also needs to be flexible by allowing outside materials to be easily uploaded. The flexibility needs to extend to allow large size files to be uploaded. The materials that will be integrated into the course will be written and multimedia including graphics and video clips which can take up a lot of space. The contents of the course will be uploaded from reusable sources or created by the designer.

***Test development software.*** For the unit assessments, the system will need to have software writing capabilities or else an independent test writing system will need to be found that can integrate with the authoring system. Assessments will be given at the end of every unit. The test writing program should be able to deliver and grade the evaluations with the ability for the trainer to change the grade if needed.

***Media and graphics.*** Multimedia content is important to grasp the skills needed to produce radiographs. The content could be presented in written and multimedia format. The multimedia format allows for in-depth exploration of the topic. The number of graphics needs to be manageable to not overwhelm the participant.

***Dental models.*** Dental models are used to point out anatomy and demonstrate dental skills. The models are designed to be as close to real life as possible. From an animal welfare perspective, it decreases the stress of the participants when they have to learn how to produce a dental radiograph.



***Dental x-ray generator and sensor.*** For the active training phase, the equipment needs to be present to allow the participants to interact with it. The interaction will engage the participant and build confidence while learning the steps of the task. The dental x-ray generator and the sensor will be purchased by the clinic and present during the training. If the training is in a lab setting, the manufacturer or distributor will provide the equipment.

***Dental x-ray software.*** For the active training phase, the x-rays are acquired by placing the tooth on a sensor, and the x-ray beam hits the sensor. The image is transferred from the sensor to the software program connected to the sensor. The image appears on the display for assessment and annotation. The participant needs to complete the basic tasks required to learn how to use the software. The software will be purchased by the clinic and present during the training. If the training is in a lab setting the manufacturer or distributor will provide the software preloaded on a laptop computer.

## **Methods and Strategies**

The three phases of training will be presented using a blended classroom. The participants will participate in pre-class training using asynchronous e-learning and live classroom interaction with the topic (Piskurich, 2015, p. 453). Assessments will be taken throughout all three phases of training. Tables 7-9 describes the strategies for each phase of training.

### **Pre-training session**

Table 7

*Pre-training Methods and Strategies*

| Methods   | Strategies   |
|---|--|
| Authoring System  | <ul style="list-style-type: none"> <li>• Research to find the system that is easiest to navigate and inexpensive.</li> <li>• Expandable to allow content from outside sources.</li> <li>• Large enough memory to handle multimedia files.</li> <li>• Testing software included.</li> <li>• Compatible LMS system to run the course.</li> </ul>                   |
| Learning Management System (LMS) or Learning Content Management System (LCMS) | <ul style="list-style-type: none"> <li>• Compare between authoring system, an LMS, and an LCMS to see which program would write and run the course most efficiently and inexpensively.</li> <li>• Which system would be the easiest for the participant to navigate?</li> <li>• Which system has an easy to reach customer or technical support line?</li> </ul> |

|  |   |
|--|---|
|  | <ul style="list-style-type: none"><li>• Can they be accessed by both the trainer and the participant?</li><li>• Participant guide will be written for each unit and lesson.</li><li>• Does the LMS or LCMS have a graphic or video content that can be used for the subject matter?</li><li>• Must be able to access all parts of the course from the home page.</li><li>• How is the progress of the participants tracked?</li><li>• What types of assessments can be written on this program?</li><li>• Can the program generate a certificate with the participant's name and date of completion?</li><li>• Materials will include written and multimedia components. The combination will allow the participant to choose the best component required to grasp the topic.</li></ul> |
|--|---|

|             |  |
|-------------|--|
|             | <ul style="list-style-type: none"> <li>• Software training must be provided to any new trainers.</li> </ul>                        |
| Assessments | <ul style="list-style-type: none"> <li>• Assessments will be in a quiz format combining forced answer and short answer.</li> </ul> |

**Active training session**

This portion of the training will be given after the pre-training is complete. The participants must present their certificate of completion to enter the training session.

Table 8

*Methods and Strategies: Active Training Session*

| Methods  | Strategies  |
|----------|---|
| Handouts | <ul style="list-style-type: none"> <li>• Training session divided into modules with concise learning objectives.</li> <li>• Modules divided into activities in a checklist format so that participants can check off completed activities during the training.</li> </ul> <p>Supplemental materials include</p> |

|                    |  |
|--------------------|--|
|                    | <ul style="list-style-type: none"><li>• Equipment user instructions.</li><li>• Software user instructions.</li><li>• Positioning guide listing sensor location and suggested tube head angle.</li><li>• Assessment checklist for participant image attempt.</li><li>• A sheet of images showing technical flaws and solutions.</li></ul>   |
| Teaching equipment | <ul style="list-style-type: none"><li>• Dental models acquired from veterinary supply company.</li><li>• Skulls acquired from an osteological supply company.</li><li>• Clear acrylic models acquired from a veterinary supply company.</li><li>• Cadaver specimens of the dog and cat acquired from a shelter or science educational supply company.</li><li>• Dental x-ray unit provided by the clinic, the manufacturer or distributor.</li></ul> |

|  |   |
|--|---|
|  | <ul style="list-style-type: none"> <li>• Dental x-ray software and corresponding digital sensor provided by the clinic, the manufacturer or distributor.</li> </ul> |
|--|---|

**Post-training Session**

The final assessment of the training will occur after the active training is completed. Participants will be asked questions about their experience with the course, particularly where they found improvement in their current knowledge base and what shortfalls they encountered. Table 9 shows the methods and strategies for the post-training session.

| Methods | Strategies  |
|---------|---|
| Survey  | <ul style="list-style-type: none"> <li>• Option 1: Give a written survey to each participant to fill out. Collect the survey from the participant.</li> <li>• Option 2: Provide a link to an online survey they can fill out on their cell phones which tabulates the results for later analysis.</li> <li>• Option 3: Blended survey: Provide either an Option 1 or Option 2 survey then have each participant answer the question,</li> </ul> |

|  |   |
|--|---|
|  | “What one learning point will follow you back to your job today?” |
|--|---|

### **Summary of Edits**

#### **Using Active Voice**

I needed to verbalize my sentences using clear, concise words and active verbs. I need to remember that I am reporting the results of my analyses.

#### **Too Wordy and Too Many “And”**

I tend to ramble when I am discussing a topic I am unfamiliar with. I need to keep my wording direct and concise. Break my lists down into single subjects.

#### **Formatting Headers**

I need to make sure my headers are in correct alignment. I also need to make sure that all areas that need to be in bold are in bold.

#### **Cite More References**

I am a SME on this topic. I assume that because I know it without looking it up, it must be a fact. I must reference all factual statements.

#### **Punctuation**

When making lists, I must remember to add periods after every sentence.

**Forget Being a SME**

I need to tackle the project like I know nothing about the training subject. I need to assume the reader also knows as little or less about the topic. I must explain why I decided to follow a particular direction.



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### **Appendix A: Data Collection Instrument(s)**

I emailed a set of four questions. Two of the questions I used for Week 2 and two of the questions I may need later. The questions I asked for Week 2 were:

1. Do you have difficulties teaching dental x-ray positioning?
2. What are the top three problems your trainees have when you teach positioning?

Some of my respondents needed extra time to complete the questions. I plan in the future to use a survey instrument such as Jotform to speed up the return rate hopefully. Jotform will allow me to write queries using various answer formats such as force choice or open-ended.

Survey Link Week 3

<https://form.jotform.com/81027807940962>

**Appendix B: SME Feedback Questions**

1. Do the prerequisite skills and tasks adequately address what the learner needs to know. Please be specific how they do address learning needs or how they don't address learning needs.
2. List any goals or interventions that are not important to the learner.
3. Are the steps in the goal sequence section in the correct order? If not, what changes would you recommend?
4. Is there anything else you feel is important that I missed? Please be specific.