

# Bridging the Gap:

## Comparing Employer and Educator Expectations in Small Animal Dentistry

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# 1 Abstract

## 2 Introduction

Dr. Mariea Ross-Estrada, a faculty member at North Carolina State University's College of Veterinary Medicine, is exploring whether there are differences between the expectations of small animal primary care veterinary employers and veterinary educators regarding new graduates' competencies in dentistry. Through her own professional experience and conversations with colleagues, Dr. Ross-Estrada observed that many veterinarians must rely on on-the-job training to gain the skills necessary in small animal dentistry. These shared experiences prompted her to investigate whether there is a misalignment in what is taught in veterinary programs and what is expected in clinical practice.

To explore this question, Dr. Ross-Estrada distributed two surveys: one to medical directors and private practice owners and the other to primary care veterinary educators. Both surveys included similar questions regarding what early-career veterinarians are expected to have learned during their education and the skills they are expected to perform in practice.

### 2.1 Research Question

How do small animal primary care employers (medical directors and practice owners) and primary care veterinary educators differ in regards to their expectations of early career veterinary graduates' competencies in small animal dentistry?

### 2.2 Statistical Questions

1. Are there significant differences between educators and practice owners in their belief that new graduates are competent in key dental skills on their first day of practice?
2. Is there a difference between educators and practice owners in their reports (educators' actual teaching vs. owners' perceptions) of which dental skills were taught in the pre-clinical DVM curriculum for recent graduates?
3. Is there a difference between educators and practice owners in their level of agreement about whether specific dental skills should be taught pre-clinically?
4. Do employers and educators differ in their expectations about how many dental procedures new graduates should complete during clinical training?
5. Is there difference between the instructional formats in dentistry reported by DVM programs and the formats perceived by employers to have been completed by early career veterinarians?
6. Do educators and employers differ in their views on which formats of clinical instruction in dentistry should be required for DVM students as part of their clinical training?
7. Is there a difference between the clinical dentistry skills that educators report DVM students are learning during their clinical training and the skills that employers believe recent graduates have completed as part of their DVM program?

8. Do educators and employers differ in their opinions about which clinical dentistry skills DVM students should be required to practice or learn during their clinical training?

## **3 Data**

### **3.1 Data Description**

Two separate surveys were administered to mutually exclusive groups: veterinary employers who have worked with students, and educators who have taught students. There was no overlap between these groups and they can be assumed to be independent.

The employer data set consists of responses from 29 participants answering 40 questions, while the educator data set includes 43 participants answering 34 questions. Each group was asked a single qualifying question to determine eligibility for participation, along with nine questions covering demographics and institutional context. Educators were then presented with 24 competency and sentiment-based questions, while employers answered 30 such items focused on professional expectations and training in veterinary medicine.

Survey questions took several forms. Some were binary (Yes/No), particularly those related to demographics and institutional affiliation. Others used a “select all that apply” format, commonly seen in questions asking respondents to identify procedures performed at their practice. Many of these questions were followed by Likert-scale items. The Likert scales were even-numbered and omitted a neutral option, which may have contributed to at least two instances where respondents selected both “agree” and “disagree” for the same item.

Several questions offered an “Other” response with a text box for elaboration. A few required numeric input, such as estimates of hours worked or the number of practicing veterinarians. These integer fields were not restricted by any upper bound, regardless of contextual reasonableness.

#### **Global survey session metrics**

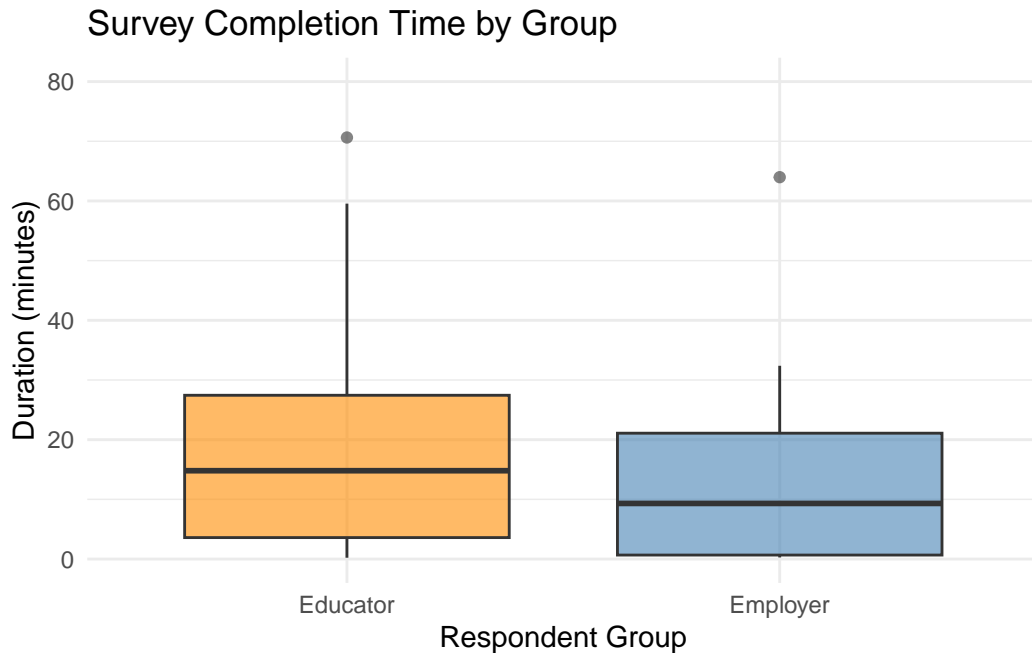


Figure 3.1: Assessing survey elapsed time distribution via box plots to understand engagement by survey group.

Survey completion time differed by group. Educators, on average, spent more time completing the survey than employers. While no follow-up question asked participants to explain their response time, this discrepancy may reflect greater engagement or a tendency for more elaborated responses among educators. It may also suggest a greater willingness among educators to participate more thoughtfully. The box plot below illustrates the distribution of survey duration (in minutes) by group.

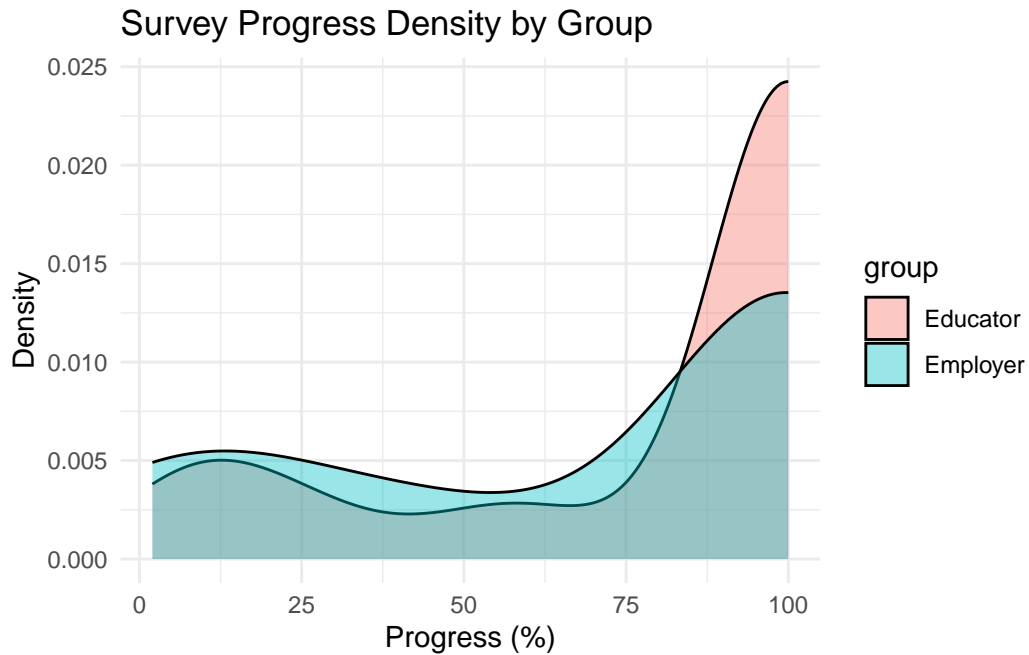


Figure 3.2: Assessing survey completion as a density curve to understand engagement by survey group.

Regarding the proportion of the survey completed, employer responses were more variable—spanning the full range from partial to full completion. In contrast, educators tended to complete more of the survey, with a concentration near full completion and a less pronounced left tail. The density plot below visualizes these differences in survey progress across groups.

### Geographic Distribution of Survey Respondents

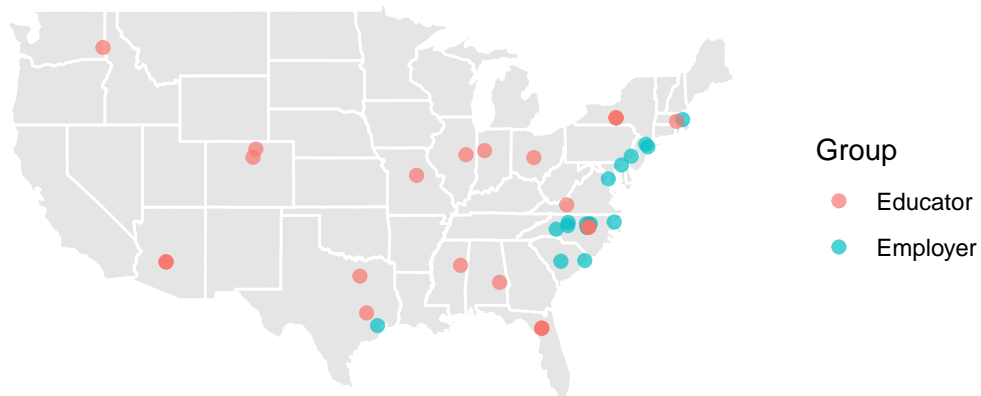


Figure 3.3: Geographic distribution of survey respondents across the United States.

Since our analysis focused on the representativeness of the United States, we identified three sets of coordinates in the educator dataset corresponding to international institutions: the University of Guelph in Ontario, Canada; Zanzibar University in Chake, Tanzania; and Chiba University in Chiba, Japan. Employer survey participants were predominantly sampled from locations along the eastern seaboard of the United States, while educators were more widely distributed across the country. We highlight this to illustrate that perceptions of veterinary dental students—particularly among employers—may differ for individuals located far from the regions where most participants were sampled. Additionally, because many of the responses came from major metropolitan areas, our findings may underrepresent opinions regarding student knowledge gaps in more rural settings.

## Educator metrics

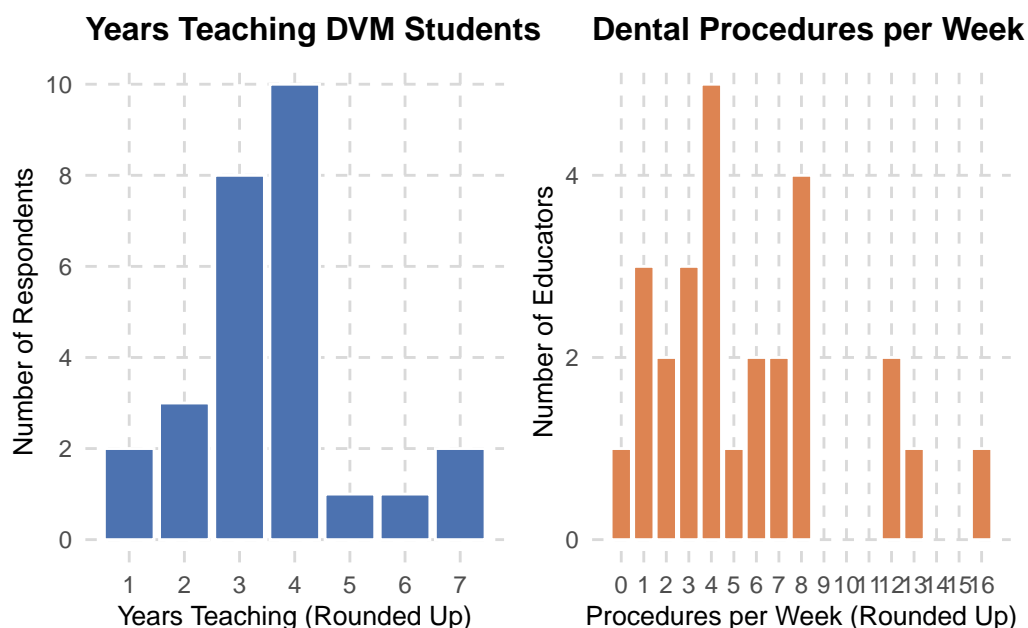


Figure 3.4: Educator contextualized background information about teaching and procedures.

Figure 3.3 provides an overview of the survey participants and their institutions. Most respondents reported having between 2 and 4 years of experience teaching veterinary students in clinical training. The distribution of years taught appears approximately normal, with fewer educators at the lower and upper ends of the experience range. Respondents also reported the number of dental procedures performed by their primary care service each week. While some outliers from busier institutions reported higher volumes, most educators estimated performing between 1 and 8 procedures per week.

## Employer metrics

Table 1: Job Setting or Organization: Counts and Percentages

Job Setting	Count	Percentage
Group corporate veterinary practice	2	16.7
Independently owned group veterinary practice	2	16.7
Independently owned single veterinary practice	7	58.3
Industry/commercial	1	8.3

Table 2: Respondent Role: Counts and Percentages

Respondent Role	Count	Percentage
Associate veterinarian	2	18.2
Practice manager/HR representative	2	18.2
Practice owner	7	63.6

Table 1 and Table 2 provide additional context about the survey respondents. The majority of respondents work in privately owned veterinary practices, and most identified themselves as the owners of those practices.

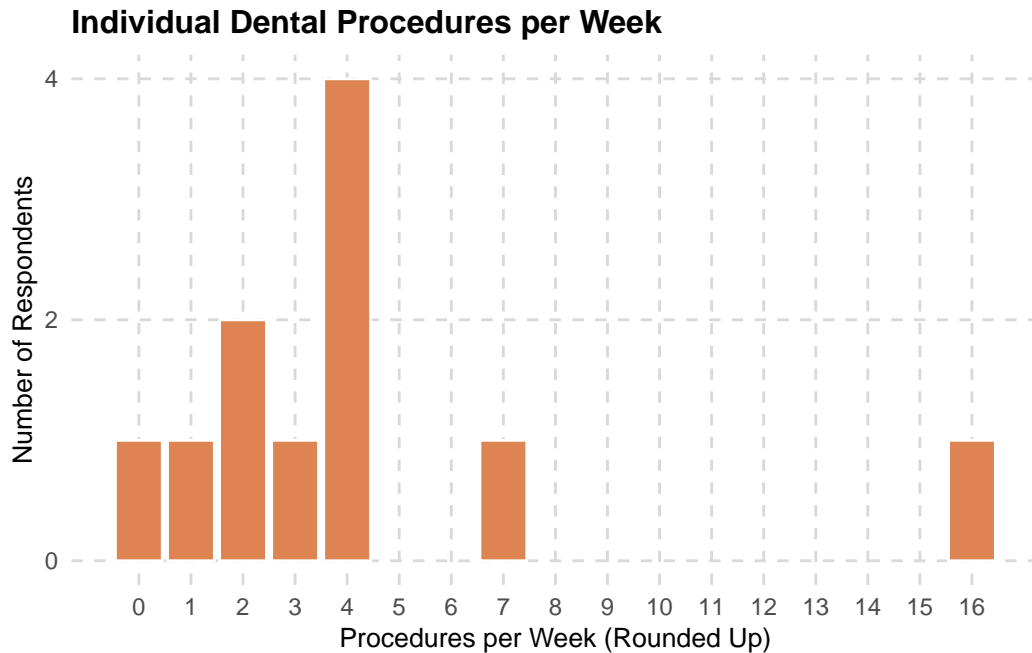


Figure 3.5: Average dental procedures employer survey participants indicated they performed each week.

Figure 3.5 shows that procedure counts tend to be lower in the employer group compared to the educator group, although the overall distribution shapes are similar. In both groups, the data exhibit a right-skewed pattern, with most respondents reporting lower procedure counts and a few outliers representing higher volumes. This pattern aligns with the intuitive understanding that while some practices or institutions have

greater clinical demands on veterinarians, these cases are less common—at least based on the survey responses.

## 3.2 Data Source

Survey data were collected using Qualtrics, a cloud-based experience management platform commonly used for gathering feedback and sentiment across workforce domains. Participants from the educator survey were recruited via email invitation sent by the researcher, using pre-existing contact lists. Dr. Ross-Estrada distributed the employer survey to her personal and professional networks online. Participation was voluntary and anonymous. There was no incentive offered for completing the survey.

## 3.3 Preprocessing Description

Although the employer and educator data sets shared a similar structure, they were not identical. Most pre-processing steps were applied uniformly across both data sets, with minor deviations where needed.

The data sets were imported into the RStudio environment (version 2024.04.1 Build 748). A new variable was created to label the data source (“Educator” or “Employer”) for later grouping and visualization. The existing `respondent_id` column served as a unique identifier and was treated as the primary key.

Initial cleaning involved removing extraneous metadata included by Qualtrics—such as survey start and end times, IP addresses, geolocation data, and question display logic—all of which were irrelevant to the analysis. These columns were trimmed to streamline the dataset for subsequent transformation and statistical work.

Column names in the original Qualtrics export were alphanumeric but often ambiguous and misleading. Many variable names did not match the corresponding survey question numbers. Our team manually mapped the exported column names to their corresponding survey questions and responses by referencing adjacent metadata fields and using deductive reasoning. This process allowed us to build an index-based column naming structure, which greatly improved the manageability and interpretability of the dataset.

Before diving into question-specific analysis, we first identified the subset of survey questions relevant to our research objectives. All unrelated or out-of-scope items were removed. This step reduced the employer dataset from 176 columns to 100, and the educator dataset from 171 columns to 102.

Several formatting inconsistencies also needed to be resolved. Some multi-select questions appeared in the form of comma-separated text responses within a single column, while others were exported into multiple binary columns. Additionally, for certain questions, a response option that received zero selections was dropped entirely by Qualtrics. To standardize these issues, we implemented a script to “explode” comma-separated responses into individual binary columns. For dropped columns, we manually reintroduced them as zero-filled dummy variables to preserve the full response structure.

Finally, we filtered out participants who answered less than half of the survey. We also excluded:

- Employers who responded “No” to the question: “Do you work with early career veterinarians (someone who has graduated from a DVM program after May 2021)?”
- Educators who responded “No” to: “Do you teach in any capacity of the dental curriculum at your institution?”



After all preprocessing steps, the final cleaned datasets consisted of 13 employer participants and 30 educator participants.

## 4 Statistical Methods

### 4.1 Method Description

Likert scale questions (statistical questions #1,3, 6, and 8): These questions utilize a likert scale to answer Strongly Agree, Agree, Disagree, or Strongly Disagree on a variety of skills and procedures. To analyze this data, we will use diverging stacked bar charts and tables for exploratory data analysis and the Mann-Whitney U Test for the formal hypothesis procedure. The Mann-Whitney U Test is a non-parametric test that does not rely on an assumption of normality. It does require independence between datasets and it is reasonable to assume that the educators and employers were independent from each other when taking the survey. The Mann-Whitney test particularly works well with these questions due to the ordinal (and therefore ranked) nature of the data.

Select all that apply questions (statistical questions #2, 5, and 7): These questions asked the participants to “select all that apply” as it relates to skills in pre-clinical curriculum, format of dental instruction, and skills for clinical training respectively. We will utilize frequency tables and bar plots to explore the data for these questions and use Fisher’s Exact Test as a formal inference procedure for the comparison of the two groups. Fisher’s Exact Test works with categorical data with independent samples, in this case educators and employers. In this context, it is preferred over Chi-Squared Tests due to the small sample size and therefore not meeting the expected count threshold that is required to proceed with Chi-Squared Tests. Given the small sample sizes, we acknowledge the limited power of these analyses and may consider post hoc power analyses for these tests.

Numerical entry questions: (statistical question #4): This question asks participants to enter a number related to the number of dental procedures that should be completed during training in different areas. We plan to produce box plots and/or histograms to visually examine the data. Depending on the normality or lack thereof of the distributions, we will then conduct either a two-sample t-test or a Mann-Whitney U Test. As mentioned above, the Mann Whitney U test is a non-parametric test that does not depend on the assumption of normality. If the assumption on normality is met, we can consider a two-sample t test for this analysis.

## 5 Results

**S1 Are there significant differences between educators and practice owners in their belief that new graduates are competent in key dental skills on their first day of practice?**

**S2 Is there a difference between educators and practice owners in their reports (educators' actual teaching vs. owners' perceptions) of which dental skills were taught in the pre-clinical DVM curriculum for recent graduates?**

**S3 Is there a difference between educators and practice owners in their level of agreement about whether specific dental skills should be taught pre-clinically?**

**S4 Do employers and educators differ in their expectations about how many dental procedures new graduates should complete during clinical training?**

**S5 Is there difference between the instructional formats in dentistry reported by DVM programs and the formats perceived by employers to have been completed by early career veterinarians?**

Both educators and employers were asked a question relating to the format of instruction during the clinical year.

Employers were asked: "What format of clinical instruction in dentistry do you believe that the early career veterinarians (individuals who have graduated from a DVM program after May 2021) hired into your practice/organization/institution completed as part of their DVM training? Select all that apply."

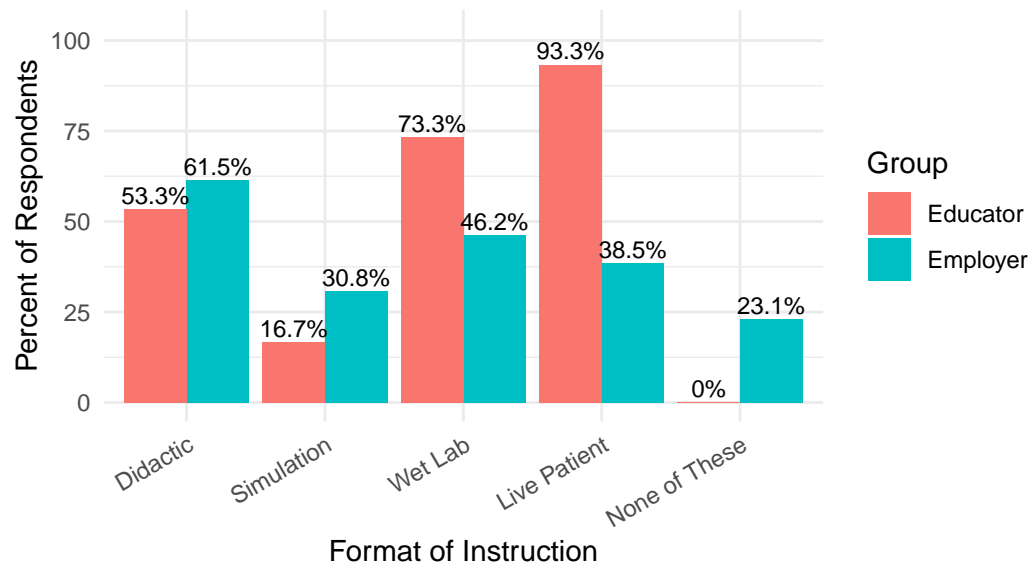
Educators were asked: "What format of instruction in dentistry does your DVM program provide during the clinical year? Select all that apply."

Since the question was of the format "select all that apply," participants were able to select more than one response and percentages will not add to 100%. Results reported below are the percentages of their respective group (educators or employers) that selected the given format of instruction. Percentages were utilized due to the difference in sample size.

Educators and employers differed in their perceptions of clinical dental instruction formats completed by early career veterinarians. While a majority in both groups acknowledged didactic instruction, educators reported higher rates of wet lab (73.3% vs. 46.2%) and live patient training (93.3% vs. 38.5%) compared to employers. Conversely, employers more frequently identified simulation training (30.8% vs. 16.7%) than educators. These differences suggest varying expectations or awareness between the two groups regarding dental training experiences of recent graduates.

\*Add here about people who entered a text response.

## Perceived Clinical Instruction Formats in Dentistry Completed by Early Career Veterinarians



The table below shows the percentages of each format selected (as seen in the bar graph above) and the p-value associated with performing Fisher's Exact Test on each format.

Didactic instruction was selected by 53.3% of educators and 61.5% of employers, with no statistically significant difference between the groups ( $p=0.743$ ). There was also no statistically significant difference in simulation ( $p=0.417$ ) and wet lab instruction ( $p=0.162$ ).

On the other hand, live patient instruction was selected by 93.3% of educators, but only 38.5% of employers. This difference was found to be statistically significant with a p-value of 0.0003.

\*Don't know whether to talk about "none of the above" being significant.

```
Warning in attr(x, "align"): 'xfun::attr()' is deprecated.
Use 'xfun::attr2()' instead.
See help("Deprecated")
```

```
Warning in attr(x, "format"): 'xfun::attr()' is deprecated.
Use 'xfun::attr2()' instead.
See help("Deprecated")
```

Format	% of Educators	% of Employers	P-value
Didactic	53.3	61.5	0.743000
Simulation	16.7	30.8	0.417000
Wet Lab	73.3	46.2	0.162000
Live Patient	93.3	38.5	0.000303
None of These	0.0	23.1	0.023200

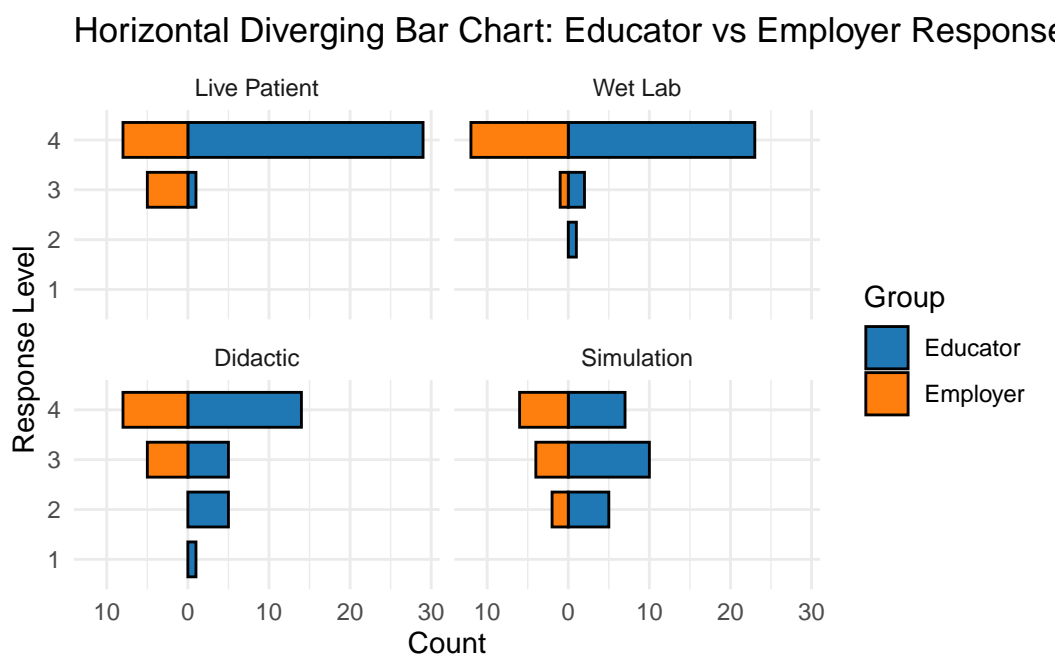
## S6 Do educators and employers differ in their views on which formats of clinical instruction in dentistry should be required for DVM students as part of their clinical training?

In question #21 of the employers version of the survey, participants were asked, “Which of the following types of *clinical instruction in dentistry* do you think that DVM students should be required to complete as part of a *DVM program*? Select one response for each of the instructional types listed below.” The analogue of this question for educators was survey question #17. We want to make a note that the educators survey question had a slight variation in phraseology. It asked, “Which of the following types of *instruction* do you think DVM students should be required to complete as part of their *clinical training*? Select one response for each type of instruction listed below.”.

This question is targeting how participants feel about what dental veterinarian medical programs are teaching and what topics should be required in their curriculum. The research question asked if there was a difference in opinions on this matter. To infer from the data, we will use the Mann-Whitney U-Test, a non-parametric test also known as Wilcoxin Rank Sign Test. This test assumes mutual exclusivity between groups.

Table 4: Mann-Whitney U-Test Results for Instruction Types

	Instruction_Type	W_Statistic	P_Value	Significance	Notes
Q17_01	Didactic	138.5	0.415	ns	Test performed
Q17_02	Simulation	108	0.363	ns	Test performed
Q17_03	Wet Lab	162	0.713	ns	Test performed
Q17_04	Live Patient	263.5	0.003	**	Test performed
Q17_05	None of these	-	-	-	Insufficient data
Q17_06	Other	-	-	-	Insufficient data
Q17_07	Other	-	-	-	Insufficient data



## S7 Is there a difference between the clinical dentistry skills that educators report DVM students are learning during their clinical training and the skills that employers believe recent graduates have completed as part of their DVM program?

Both educators and employers were asked a question related to skills learned and practiced during the clinical year.

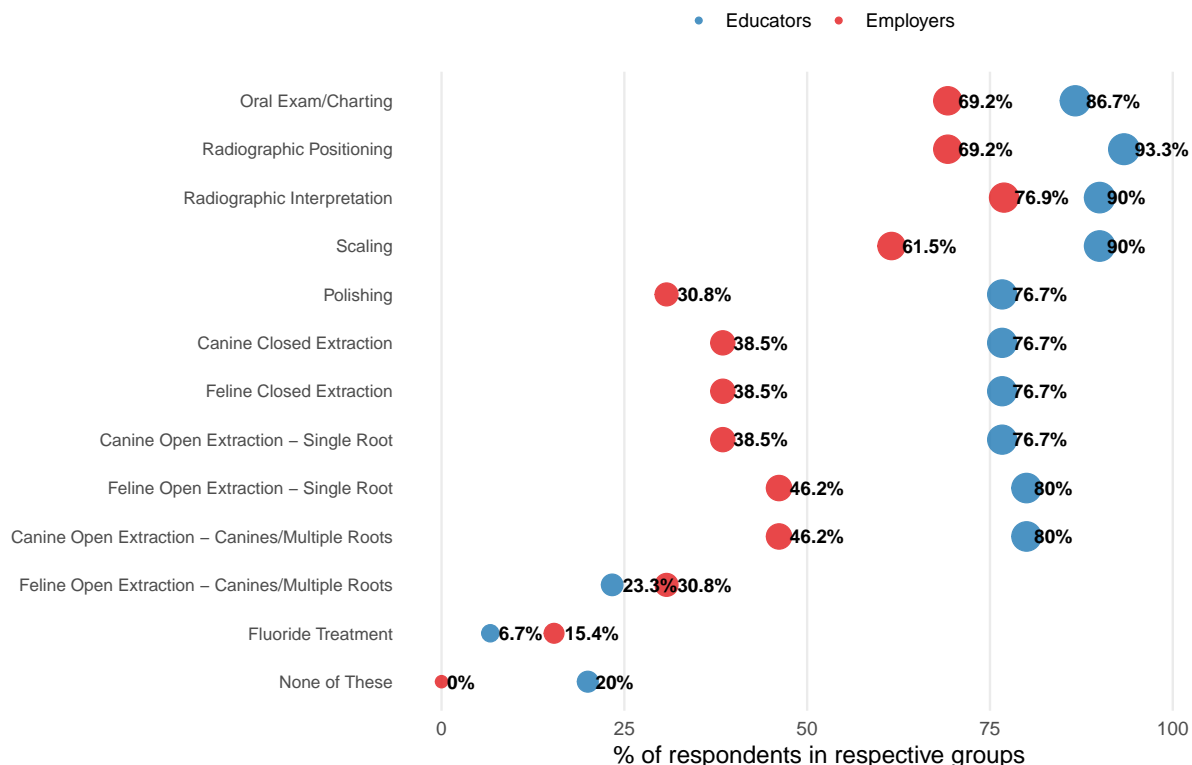
On question 25 of their survey, employers were asked: “Which of the following skills do you think that individuals who graduated with a DVM degree after May 2021 completed during the clinical training portion of their DVM program? Select all that apply.”

On question 20 of their survey, educators were asked: “Which of the following skills are DVM students at your institution practicing/learning during the clinical training portion of the DVM program? Select all that apply.”

Since the question was of the format “select all that apply,” participants were able to select more than one response and percentages will not add to 100%. Results reported below are the percentages of their respective group (educators or employers) that selected the given format of instruction. Percentages were utilized due to the difference in sample size.

### Clinical Training Skills Perceived by Educators vs Employers

Each dot shows percent of Educators or Employers who selected each skill



Warning in attr(x, "align"): 'xfun::attr()' is deprecated.

Use 'xfun::attr2()' instead.

See help("Deprecated")

Warning in attr(x, "format"): 'xfun::attr()' is deprecated.  
 Use 'xfun::attr2()' instead.  
 See help("Deprecated")

Skill	% of Educators	% of Employers	P-value
Oral Exam/Charting	86.7	69.2	0.21700
Radiographic Positioning	93.3	69.2	0.05760
Radiographic Interpretation	90.0	76.9	0.34500
Scaling	90.0	61.5	0.04150
Polishing	76.7	30.8	0.00672
Canine Closed Extraction	76.7	38.5	0.03390
Feline Closed Extraction	76.7	38.5	0.03390
Canine Open Extraction - Single Root	76.7	38.5	0.03390
Feline Open Extraction - Single Root	80.0	46.2	0.03670
Canine Open Extraction - Canines/Multiple Roots	80.0	46.2	0.03670
Feline Open Extraction - Canines/Multiple Roots	23.3	30.8	0.70900
Fluoride Treatment	6.7	15.4	0.57200
None of These	20.0	0.0	0.15500

## **S8 Do educators and employers differ in their opinions about which clinical dentistry skills DVM students should be required to practice or learn during their clinical training?**

In question #26 of the employers version of the survey, participants were asked, “Which of the following skills do you think that DVM students should be required to practice/learn as part of the clinical training portion of a DVM program? Select one response for each of the skills listed below.” The analogue of this question for educators was survey question #21

This question hits at the sentiment on what both groups think should be required practice/learnings for students. The research question asked if there was a difference in opinions on this matter. To infer from the data, we will use the Mann-Whitney U-Test, a non-parametric test also known as Wilcoxin Rank Sign Test. This test assumes mutual exclusivity between groups.

	question	W	p_value
Q21_07	Feline closed extraction	104.5	0.04863265
Q21_08	Canine open extraction - Single root	104.5	0.04892603
Q21_09	Feline open extraction - Single root	115.5	0.07564530
Q21_10	Canine open extraction - Canines/multiple roots	115.5	0.07587786
Q21_03	Radiographic interpretation	126.5	0.19379896
Q21_11	Feline open extraction - Canines/multiple roots	54.0	0.20728866
Q21_06	Canine closed extraction	127.5	0.32836731
Q21_01	Oral exam/charting	139.0	0.62171592
Q21_02	Radiographic positioning	157.0	0.71723375
Q21_04	Scaling	156.0	0.76158684
Q21_05	Polishing	148.5	1.00000000
Q21_12	Fluoride treatment	NA	NA

Q21_13		None	NA	NA
Q21_14		Other: Please describe	NA	NA
	significance			
Q21_07	*			
Q21_08	*			
Q21_09	.			
Q21_10	.			
Q21_03	ns			
Q21_11	ns			
Q21_06	ns			
Q21_01	ns			
Q21_02	ns			
Q21_04	ns			
Q21_05	ns			
Q21_12	<NA>			
Q21_13	<NA>			
Q21_14	<NA>			

```
view(Educator_Data_Clean %>% select(starts_with("Q17")))
view(Employer_Data_Clean %>% select(starts_with("Q21")))
```

## 5.1 Findings

## 5.2 Statistical Analysis

# 6 Discussion/Conclusion

## 6.1 Interpretation of Results

In statistical question six, when asked, “Which of the following types of clinical instruction in dentistry/instruction do you think that DVM students should be required to complete as part o a DVM program/Clinical training?”, we found that there was no statistical difference between groups on the medical procedures “Didactic”, “Simulation” or “Wet Lab”. There was a statistically significant difference on sentiments of whether a student or recent graduate should be taught on “Live Patients”. The survey gave the option of “None of These” or “Other”; however, not enough data was present to make viable comparisons on these groups.

Statistical question eight asked, “Which of the following skills do you think that DVM students should be required to practice/learn as part of the clinical trainingportion of a DVM program? Select one response for each of the skills listed below.”

## **6.2 Implications of the Study**

## **6.3 Limitations**

## **6.4 Recommendations**

## **6.5 Summary of Key Findings**

## **6.6 Final Thoughts**

# **7 Appendix**