Teaching Notes for
Dragon Card Lesson Plan: Categorical Data
Curriculum Level 3

Statistics
Learning
Centre

Overview

You can buy dragon cards and download more free lessons at: shop.StatsLC.com

Achievement Objectives

S3-1: Conduct investigations using the statistical enquiry cycle: gathering, sorting, and displaying multivariate category … to answer questions; identifying patterns and trends in context, within and between data sets; communicating findings, using data displays.

Purpose

Investigating of multivariate data using a set of dragon cards. Each dragon card provides several pieces of information about one dragon. Sorting and organising a set of dragon cards makes it possible to uncover information about the set.

Specific Learning Outcomes

- Sort information into categories.
- Display data in an appropriate format.
- Answer questions by sorting, organizing and arranging information.
- Make sensible statements about the information with supporting evidence.

Outline

Part 1 – Understanding the dataset
  ➢ Getting to know the dragon cards [Full class, 10 min]
Part 2 – Categorical data
  ➢ Dragon vaccination story [Full class, 5 min]
  ➢ Posing questions - [Full class, 5 min]
  ➢ Exploring and comparing - [Groups, 20 min]
  ➢ Results and conclusions - [Groups, 10 min]
  ➢ Further investigation - [Groups, remaining time]
  ➢ Finish up - [Full class, 5 min]

Equipment

- Pack of dragon cards (allow 240 cards for a group of up to 32 students)
- Paper for students to record their results

Key Vocabulary

Categorical data, dataset, numerical data, statistical enquiry cycle.

Teacher Notes

Timings are approximate. Groups are likely to work through the phases at their own pace.

The statistics strand of the New Zealand mathematics curriculum is made up of three threads: Statistical Investigation, Statistical Literacy and Probability at all curriculum levels. This lesson is a part of the Statistical Investigation thread. The Statistical Enquiry Cycle underlies that thread.

The Statistical Enquiry Cycle is also called the PPDAC cycle. The steps in the PPDAC cycle are: Problem, Plan, Data, Analysis and Conclusion.

Part 1 - Understanding the data set
Getting to know the dragon cards [Full class, 10 min]

The third phase of the Statistical Enquiry Cycle is "Data". When an existing data set (in this case, the group's set of dragon cards) is being used, the investigator needs to become familiar with the data, to understand what it represents, includes and what the limitations of the data are. This understanding of the data set is used to inform the initial Problem and Plan phases of the Statistical Enquiry Cycle.

As well as being able to decode all of the information on the Dragon Cards, students should start becoming familiar with the symbols and categories.

The activity in this part of the lesson also models a possible analysis method. This can help to scaffold the analysis in the later part of the lesson.

Another option here is to get the students to try to find another student (or students) with four things or more on their cards that match. When they find a match they should hold up their hands with fingers showing how many things match.

Part 2 - Categorical data
Dragon vaccination story [Full class, 5 min]

A statistical investigation is more than just the analysis. It is important to have a context, which will give the investigation its purpose. This will inform the statistical questions to ask, the appropriate analyses and give meaning to the conclusions. In a statistical investigation (or lesson) it should be easy to answer the "why are we doing this" questions.

The story is intended to provide context and purpose. It is an important part of the lesson.

Posing questions - [Full class, 5 min]

Best practice for investigative questions is to structure the question so that the analysis of the investigation is self-evident.

The investigative question is "Is the behaviour of our green dragons more likely to be dangerous than the behaviour of our red dragons?"

Here, the key element, behaviour, is at the very front of the question. The two populations to compare are clear: behaviour of our green dragons and behaviour of our red dragons. The comparison "more likely to be dangerous" suggests comparing the proportions of dangerous dragons in the two groups. At this level the questions are focussed on the group's set of dragons by use of "our".

It is useful for the teacher to model this best practice but, at this stage, it is fine for students to pose less clear questions e.g., "Are more red dragons dangerous?"

Exploring and comparing - [Groups, 20 min]

Let students organise the data in ways that make sense to them. This lets students either discover a good way to organise the data or see the advantages of the tabular organisation when they see it.

Randomly allocated cards can lead to quite different results from different groups, e.g., one group may have very few red dragons. Depending on your students and your confidence you might find it useful to 'stack' the decks prior to class, so that each group gets similar results, so that certain groups get similar numbers of red and green dragons, or so that you know the expected results. It is important that all groups do **not** get the same result.

Results and conclusions - [Groups, 10 min]

Recording results is important. This provides the evidence from the statistical investigation. Results are not conclusions. In this case, the comments on the results form the conclusions.

Don't expect students to be able to use the framework given without being taught how to use it. Use it to encourage students to improve their sentences to the next level. For example, you might ask: "What evidence do you have that there are more dangerous red dragons?" or, "What does that mean for the vaccinations? Should the red or green dragons be vaccinated first?"

Conclusions should focus on the outcomes for the students' own group. Inference (inferring properties of the whole population of 240 dragon cards based on what students find from their 30 dragons) comes at a higher level of statistical understanding. As appropriate, the teacher might ask questions to get students thinking about and discussing that concept.

Students can be eager to get onto another investigation of the Dragon Cards. Before allowing that, make sure that they have recorded a concluding statement. Preferably the concluding statement should be meaningful to the context, that is, advice about the vaccinations.

Since the groups will generally have different results, minor counting or sorting errors can be ignored. Of course accuracy is important, however, the focus of this lesson is on the statistical investigation not counting and sorting.

Further investigation - [Groups, any remaining time]

This allows students who finish their investigation faster to practice the Problem, Analysis and Conclusions phases. Students can be eager to get to the analysis phase so, where appropriate, get them to pose, and possibly write down, their question first.

The questions should be driven by the previous investigation. That doesn't mean the questions need to directly address the vaccination scenario. The question could, instead, arise directly from exploring the cards. Student questions do not need to follow best practice. It is also fine for students to refine or adapt their questions during the analysis.

Some possible categorical questions:

Questions directly relevant to the vaccination scenario:
- Is the behaviour of male dragons more likely to be dangerous than the behaviour of female dragons?
- Is the behaviour of red female dragons more likely to be dangerous than the behaviour of red male dragons, green female or green male dragons?
- Are the breath-types of green dragons in similar proportion to the breath-types of red dragons?

Other questions:
- Is the gender of red dragons more likely to be male than the gender of green dragons?
- Are the breath-types of friendly dragons in similar proportion to the breath-types of dangerous and unpredictable dragons?

Finish up - [Full class, 5 min]

Note the concepts of sampling from a population and inference to the population are at level 5 in the NZ Curriculum. At level 3 we are concerned with descriptive statistics, but students may gain an idea that different samples will give slightly different results. This will help for when the concepts of sampling and inference are introduced.

Descriptive statistics describe features of the distribution. That can be statements about a single category or the overall shape of the distribution.

Further activities and resources are provided on http://shop.StatsLC.com
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