Example Context Elaboration: Memory Test

Focus: Experimental design

Achievement objective S8-1

In a range of meaningful contexts, students will be engaged in thinking mathematically and statistically. They will solve problems and model situations that require them to:

Carry out investigations of phenomena, using the statistical enquiry cycle:

A conducting experiments using experimental design principles, conducting surveys, and using existing data sets

B finding, using, and assessing appropriate models (including linear regression for bivariate data and additive models for time-series data), seeking explanations, and making predictions

C using informed contextual knowledge, exploratory data analysis, and statistical inference

D communicating findings and evaluating all stages of the cycle.

Comparison of two independent groups

Students are expected to inform themselves on the context for the investigation. They should be introduced to some key information about memory and memory processes e.g. working memory, short-term memory etc., and then asked to find out information about research that has been conducted into memory of different things such as words, objects, faces, and sounds. Students could also participate in online memory tests, such as face recognition tests. This will enable them to have some background knowledge about memory tests.

Problem

Discuss with students whether some words are easier to remember than others. Examples to compare could be: Are concrete words easier to remember than abstract words? Are "real" words easier to remember than nonsense words? Are short words easier to remember than long words?

The problem for this investigation will be "Do Year 13 students at this school tend to remember more nouns than non-nouns?"

Plan

This problem will be investigated using an experiment. The design for this experiment will involve the comparison of two independent groups. One group will be given a list of 15 nouns, and one group will be given a list of 15 non-nouns to memorise.

Discuss with the students how they will decide who the groups are made up of (who will receive nouns, and who will receive non-nouns). Discuss other factors that might influence a person's ability to memorise words e.g. gender, age, familiarity with words, previous experience with memorising words (actors).

Discuss how the words for the test will be selected and the order they will be presented on the test. Discuss how some words may be more familiar to students, and how some groups of words might be more easily remembered (e.g. if they can be linked to make a story). Words should be randomly ordered to minimise these kinds of bias.

Discuss whether you could use one class as one group, and another class as another group (convenience sample), and what biases could result. The key idea is that in our experiment we want to measure the effect of the type of words on memory, not other factors. Discuss randomly assigning students into one of the two groups. Emphasise that only one group gets the noun memory test, and the other group gets the non-noun memory test.

Discuss how the memory test will be carried out. Will it be a paper test or online test? Will the words be read out to students, or will they read them themselves? Can the test be completed anonymously? Discuss how the conditions for the test need to be the same for each group (same environment, same instructions, same seating arrangements etc.)

<u>Procedure:</u>
All students will be given one minute to memorise as many words as possible. All students will be asked to turn over the list and then write down as many words as they can recall. They will be given two minutes to do the recall.

Data

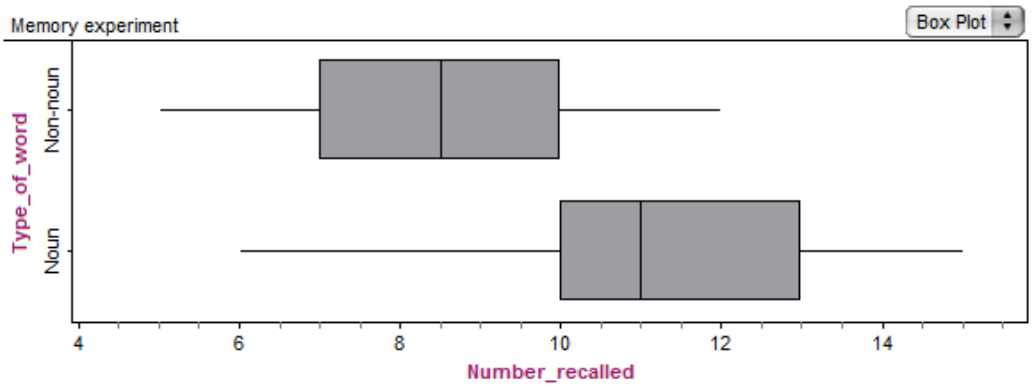
Discuss how they will collect the data – will students self-report their score? Or will they hand their sheets in for scoring?

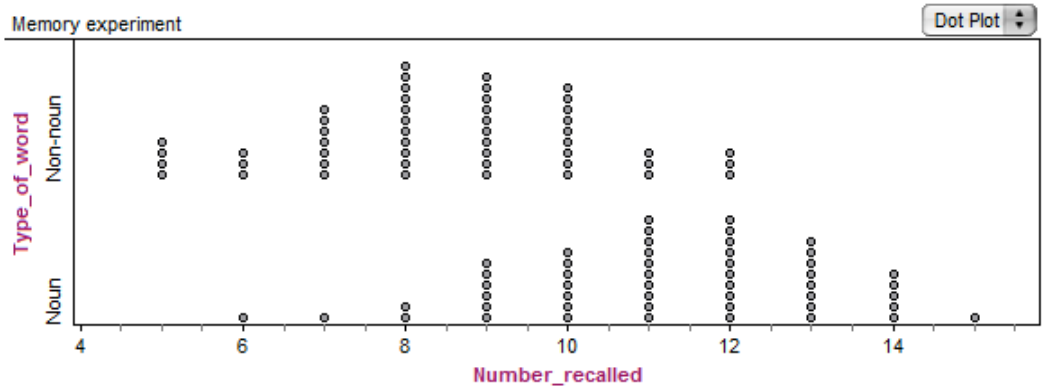
Structure the data in a spreadsheet with three columns: student, the type of word, and how many of these words were correctly recalled e.g.

Student	Type_of_word	Number_recalled
1	Nouns	9
2	Non-nouns	6
3	Nouns	11

(see example at the end of this document)

Analysis





Memory experiment

	Type_of_word		Row Summary
	Non-noun	Noun	
Number_recalled	50	51	101
	8.48	11.2157	9.86139
	5	6	5
	7	10	8
	8.5	11	10
	10	13	12
	12	15	15

S1 = count ( )
S2 = mean ( )
S3 = min ( )
S4 = Q1 ( )
S5 = median ( )
S6 = Q3 ( )
S7 = max ( )

Students should analyse and interpret the data, including finding the confidence interval for the difference of two means/medians to estimate the size of the effect. Students could also assess the strength of evidence for the effect using randomisation methods.

Conclusion

Reflection

Students should compare the results from the comparison of two independent groups experiment and the paired comparison experiment. They should reflect on any differences in estimates made, consider the different designs of the experiment and the analysis that was completed for each type of experiment.

Extension activity

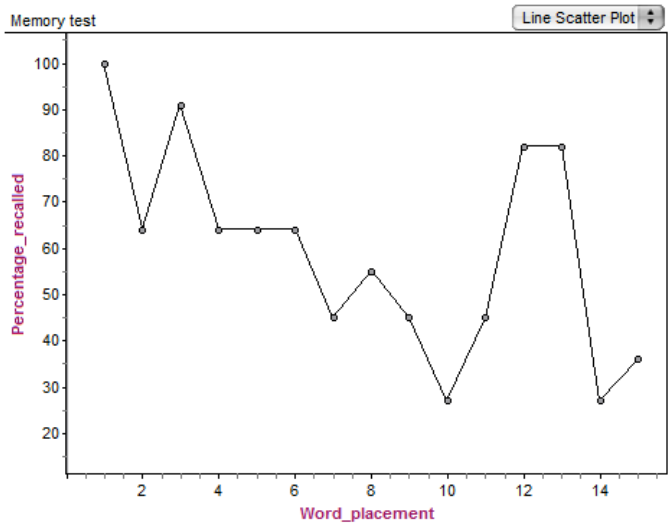
Is gender a factor in the recall of nouns and non-nouns? Are there other variables that should be measured at the time of the experiment (e.g. gender, age, time of day) that could be used to explore the data further.

Is the order of words a factor in the recall of nouns and non-nouns? For the same list of words, presented in two different orders…..

Further exploration

Students can consider what other information they can obtain from the experiments. What they would like to explore further may require changes to how they record the data.

Does word position related to the percentage of students who recall the word? Research would indicate that words at the beginning of the list are recalled better than words in the middle of the list (primacy effect), and words at the end of the list are recalled better than words in the middle of the list (recency effect). Students would need to record for each individual participating whether they recalled each word on the list.



Were particular words recalled better than other words? Does a word have a particular association for that group of students? (bar graphs can be drawn for each word, with the percentage of the class that recalled it).

What was the typical number of words sequentially recalled? Do some students display evidence of using a memory technique?

Can you improve memory? Design an experiment where one group learns a memory technique such as chaining visualisations, and one group is a control group.

Sample data

Student	Type_of_word	Number_recalled	Percentage recalled
3	Non-noun	5	33
19	Non-noun	5	33
52	Non-noun	5	33
98	Non-noun	5	33
6	Non-noun	6	40
11	Non-noun	6	40
14	Non-noun	6	40
27	Non-noun	7	47
47	Non-noun	7	47
49	Non-noun	7	47
77	Non-noun	7	47
81	Non-noun	7	47
86	Non-noun	7	47
100	Non-noun	7	47
4	Non-noun	8	53
8	Non-noun	8	53
9	Non-noun	8	53
26	Non-noun	8	53
35	Non-noun	8	53
42	Non-noun	8	53
66	Non-noun	8	53
87	Non-noun	8	53
88	Non-noun	8	53
89	Non-noun	8	53
90	Non-noun	8	53
17	Non-noun	9	60
34	Non-noun	9	60
53	Non-noun	9	60
56	Non-noun	9	60
62	Non-noun	9	60
63	Non-noun	9	60
64	Non-noun	9	60
74	Non-noun	9	60
96	Non-noun	9	60
101	Non-noun	9	60
2	Non-noun	10	67
22	Non-noun	10	67
24	Non-noun	10	67
32	Non-noun	10	67
45	Non-noun	10	67
54	Non-noun	10	67
58	Non-noun	10	67
91	Non-noun	10	67
97	Non-noun	10	67
5	Non-noun	11	73
69	Non-noun	11	73
92	Non-noun	11	73
70	Non-noun	12	80
80	Non-noun	12	80
94	Non-noun	12	80
85	Noun	6	40
48	Noun	7	47
59	Noun	8	53

61	Noun	8	53
10	Noun	9	60
20	Noun	9	60
33	Noun	9	60
44	Noun	9	60
78	Noun	9	60
95	Noun	9	60
25	Noun	10	67
36	Noun	10	67
37	Noun	10	67
41	Noun	10	67
43	Noun	10	67
60	Noun	10	67
93	Noun	10	67
1	Noun	11	73
7	Noun	11	73
21	Noun	11	73
23	Noun	11	73
28	Noun	11	73
31	Noun	11	73
40	Noun	11	73
46	Noun	11	73
55	Noun	11	73
76	Noun	11	73
15	Noun	12	80
16	Noun	12	80
29	Noun	12	80
30	Noun	12	80
51	Noun	12	80
67	Noun	12	80
72	Noun	12	80
73	Noun	12	80
82	Noun	12	80
99	Noun	12	80
18	Noun	13	87
38	Noun	13	87
50	Noun	13	87
57	Noun	13	87
65	Noun	13	87
68	Noun	13	87
75	Noun	13	87
79	Noun	13	87
12	Noun	14	93
13	Noun	14	93
71	Noun	14	93
83	Noun	14	93
84	Noun	14	93
39	Noun	15	100