2nd Year Mixed Ability Class: Rich, Happy, Famous or Healthy??

For the lesson on January 18th 2017
At Ramsgrange Community School, New Ross, Co. Wexford
Teacher: Shauna Power
Lesson plan developed by: Olive McGuinness, Julie Duggan & Shauna Power

1. Title of the Lesson

Rich, Happy, Famous or Healthy??

2. Brief description of the lesson

Using their prior knowledge, students will present collected data graphically in their own preferred form.

3. Aims of the Lesson

We would like our students to appreciate that mathematics can be used to solve real world problems, to emphasise to students that a problem can have several equally valid solutions, to foster my students to become independent learners.
We would like to support our students in developing their literacy and numeracy skills through discussing ideas.

4. Learning Outcomes: As a result of studying this topic students will be able to:

1. represent data graphically.
2. appreciate the necessities for precision so that graphs are clearly presented.
3. acknowledge how different graphs can be used to represent the same information.
4. infer knowledge or draw conclusions from graphs.

5. Background and Rationale

(a) According to the syllabus, students' learning outcomes for this topic include:

- Selecting appropriate methods to represent and describe data.
- Evaluating the effectiveness of different displays in representing the findings of a statistical investigation conducted by the Census.
- Use of pie charts, bar charts, line plots and histograms to display data.

(b) Difficulties that may arise during this series of lessons include:

- Converting data into percentages/degrees.
- Spatial awareness of bar charts and histograms.
- The importance of labeling axes.
- Dexterity issues relating to geometry sets.

(c) Our long term learning goals:

- We would like our students to experience meaningful Maths, students will have the opportunity to generate their own primary data, making the learning process more

genuine and relevant to their own lives.

- Students become more informed consumers and can identify methods used by advertising companies to manipulate data through the incorrect use of statistics and presentation of data.
- Students appreciate how several subjects; science, geography, business, C.S.P.E and Maths can be connected.
- Key Junior Cycle skills developed include, managing information and thinking, being creative, communicating and being numerate.

We have focused on these aims to communicate to the students how the material they are exploring in school can be applied to their everyday lives. Students are given greater control over their own learning as they became active members in the learning process.

6. Research

Census at School 2016; CensusAtSchool 2016 is a non-profit making international project funded by organisations in promoting good use of statistics, mathematics and data handling. 4,199 (1.1%) from an estimated 380,000 secondary school students completed the Phase 15 questionnaire of the CensusAtSchool survey between September 2015 and August 2016.

Materials: CensusAtSchool questionnaire phase 9, from the Maths Development Team website, www.projectmaths.ie Text and Tests 1 & 2, junior cycle mathematics syllabus (page 16) section 1.6, geometry sets, show me boards, flip chart.

7. About the Unit and the Lesson

Students are active participants in their own learning by completing the CensusAtSchool survey. A lesson will be dedicated to address any numeracy or literacy issues related to the Census so that the students have a full understanding the learning targets that are expected of them.

The Problem - Working individually, students are required to present the class data from question 11 for a local newspaper.

The data to be analysed and presented graphically is more meaningful as it is their own primary generated data. Students have an opportunity to independently engage in the activity.

Students benefit from the process of a class discussion of peer's ideas, promoting co-operative learning. Each student will be able to provide a solution to the key question depending on their prior knowledge, thus the lesson will fall within their zone of proximal development and all students will feel a sense of accomplishment. During the discussion of student responses students will have an opportunity to compare and contrast their work with the work of their peers, highlighting the different approaches to solving the same problem. Students will observe the need for accurate, well labelled graphs. They will note how students can present the same data using different types of graphs. Finally, students consider how their graphs will be interpreted by others, developing their own skills of inferential statistics.

Junior Certificate Mathematics Syllabus

Topic	Description of Topic Students learn about	Learning Outcomes Students should be able to
1.6 Representing data graphically and numerically.	Methods of representing data. Students develop a sense that data can convey information and that organising data in different ways can help clarify what the data have to tell us.	Graphical -select appropriate methods to represent and describe the sample. -evaluate the effectiveness of different displays in representing the findings of a statistical investigation conducted by others -use pie charts, bar charts, line plots, histograms, stem and leaf plots and back-to-back stem and leaf plots to display data -use appropriate graphical displays to compare data sets

http://www.ncca.ie/en/Curriculum_and_Assessment/Post-Primary_Education/Project_Maths/Syllabuses_and_Assessment/JC_Maths_English_2013.pdf

8. Flow of the Unit:

Lesson		# of lesson periods
1	• Students complete CensusAtSchool Survey	1 x 40 min.
2	• Survey results are discussed and key words are explored	1 x 40 min.
3	• Students graphically present some results of their CensusAtSchool Survey	1 x 40 min. **(research lesson)**
4	• Statistics 3 – Presenting Data (Chapter 15 in Text and Tests): Line and Bar Charts • Statistics 3 – Presenting Data (Chapter 15 in Text and Tests): Pie Charts • Statistics 3 – Presenting Data (Chapter 15 in Text and Tests): Stem and Leaf Plots • Statistics 3 – Presenting Data (Chapter 15 in Text and Tests): Histograms	2 x 40 min. 2 x 40 min. 2 x 40 min. 1 x 40 min.
5	• Statistics 3 – Presenting Data (Chapter 15 in Text and Tests): Misleading Graphs and Deciding the Most Appropriate Graph to Present Data	1 x 40 min.

9. Flow of the Lesson

Teaching Activity	Points of Consideration
Introduction (7 minutes) Student Task (10 minutes) Discussion 1 (13 minutes) Student reflection/closure (10 minutes)	
1. Introduction On Monday we completed the CensusatSchool Phase 9 Questionnaire (appendix 1). Yesterday you were given the primary data generated by our class. Today we are going to complete the data handling cycle (appendix 2) Prior Knowledge: Completing the CensusAtSchool survey. Primary data generated from the survey. (Deliberate decision not to recall different methods/graphs of presenting data to prevent limiting student thinking). Data handling cycle.	Teacher Activity: display the results of question 11 a poster to the left of the board. Distribute worksheet with clear written instructions.
2. Posing the Task Working individually, students are required to present the class data from question 11 for a local newspaper (appendix 3).	Students will be allowed to ask questions to clarify any misunderstandings they may have of their task. Teachers can also observe student behavior, actions and motivation towards the task.
3. Anticipated Student Responses We would expect students to present the data using: • Percentages • Fractions • Graphs • Tables • Words • Diagrams • Mind map • Verbally	We anticipate that all students will be able to present the data in some form within the time limit allocation. Students will be encouraged to present the data in as many forms they can think of. Students will write into their copies. Then, students will be asked to use one of their selected methods to present the data on a show me board.
4. Comparing and Discussing (Ceardaiocht) Four/Five students will be selected to present their show me boards and work to the class. 1st Student: a non-graphical presentation 2nd student: a non-graphical presentation 3rd student: most common graphical presentation 4th student: second most common graphical presentation. 5th student: unique graphical presentation	Students will appreciate the importance of accuracy, scaling, labeling axes, title of graph. Students will appreciate how graphical presentation of data may be more useful than using lists of results. Students can listen to each other's opinion to deepen their own understanding, promoting cooperative learning.

The teacher will facilitate classroom discussion by encouraging students to identify the differences and similarities between each presentation.	
5. Summing up Students will appreciate that there are equally valid solutions to the same problem. Factors that will affect the method used include: - prior knowledge - whether the data is numerical or categorical -the number of data choices -resources available -time constraints Students reflect on their learning and will demonstrate the level of understanding they have constructed during the lesson. Students will indicate whether they achieved the learning objectives of this lesson with an exit slip (appendix 4). Students write a conclusion on what they can infer from their presentation of the data, completing the data handling cycle. This activity also acts as assessment for learning as it informs the teacher of the quality of student learning, facilitating in the lesson evaluation and providing insight into planning of subsequent lessons.	Time management will determine the length and depth of the closure discussion. Student engagement, the effectiveness of the problem posed, the usefulness of the show me boards plain and grid, the clarity of the instructions provided. In the post-lesson discussion we will evaluate the lesson and determine if we have reached our own targets. The data handling cycle image is displayed to demonstrate that the process has been completed over the three days: data was collected, analysed and interpreted.

10. Evaluation: Plan for Observing Students

- Lesson note will be used for observing the students and documenting the students work.
- An observation document (appendix 6) will also be used by each of the three observers to monitor the student's work.
- Julie, Olive and Jimmy & Aidan will observe one row of students each – see seating plan in appendix 5. Students present the data of question 11 on graph paper sheets before each student is asked to present one of their graphs/representations on a show me board to facilitate the Ceardaiocht process.
- The types of questions students ask, their motivation, behaviour and performance will be observed. Problem solving thinking, active learning and student engagement will be focused on (see table below).
- Photographs of student work will be taken in addition to the notes taken by the observers to document student's work.
- Students' exit slips (appendix 4) will also be collected and analysed to facilitate the lesson evaluation and help determine whether the learning objectives have been achieved.

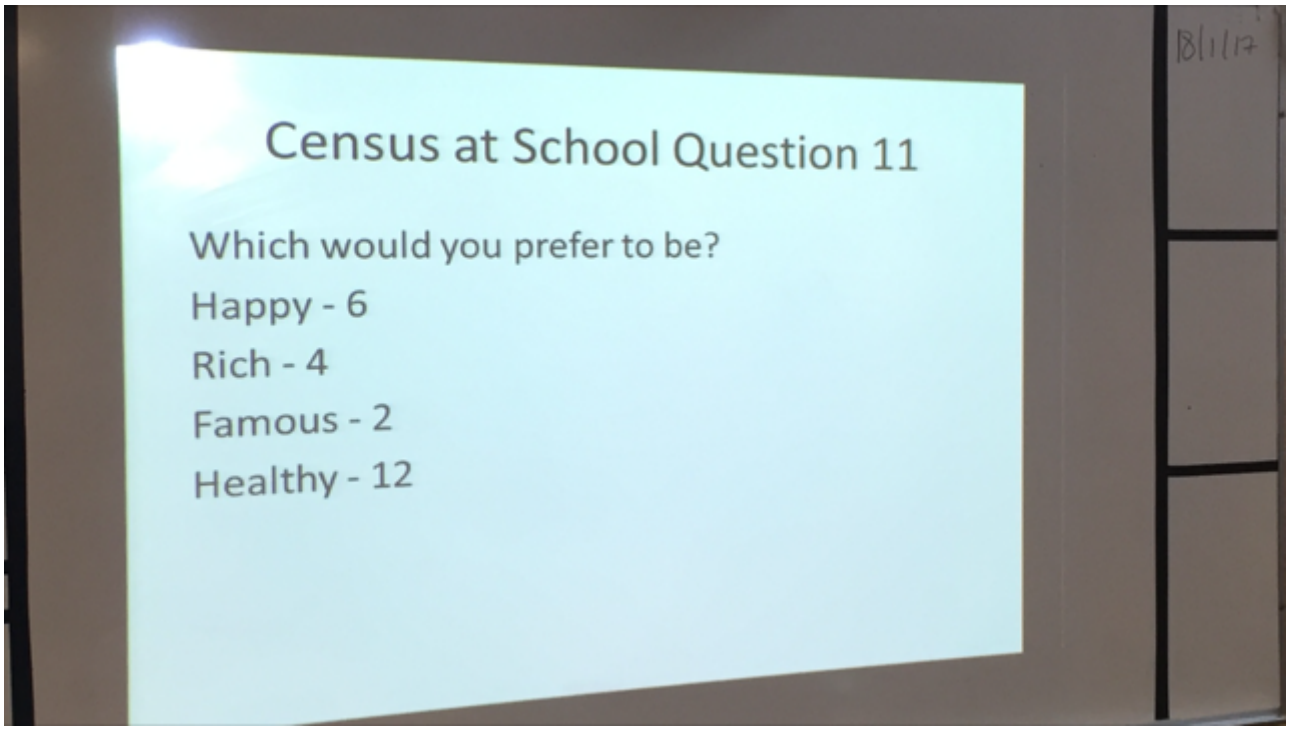
Plan for Observation

Introduction of the Task	- Can students recall the Census at School questionnaire? - Can students describe the data handling cycle? - Was the wording of the task clear? - Was there any questions asked by the students?
Individual Work	- Can students present data graphically and/or non-graphically? - Are prompts required? - What skills to they employ when presenting data accurately? - How long did students spend on the task? - What kinds of questions did the students ask? - Do the students persist with the task?
Discussion	- Are students willing to present their work to their peers? - Are students attentive to what is happening at the board when their peers are presenting? - Are clarifications needed to presenter's board work? - Did the discussion promote student learning?

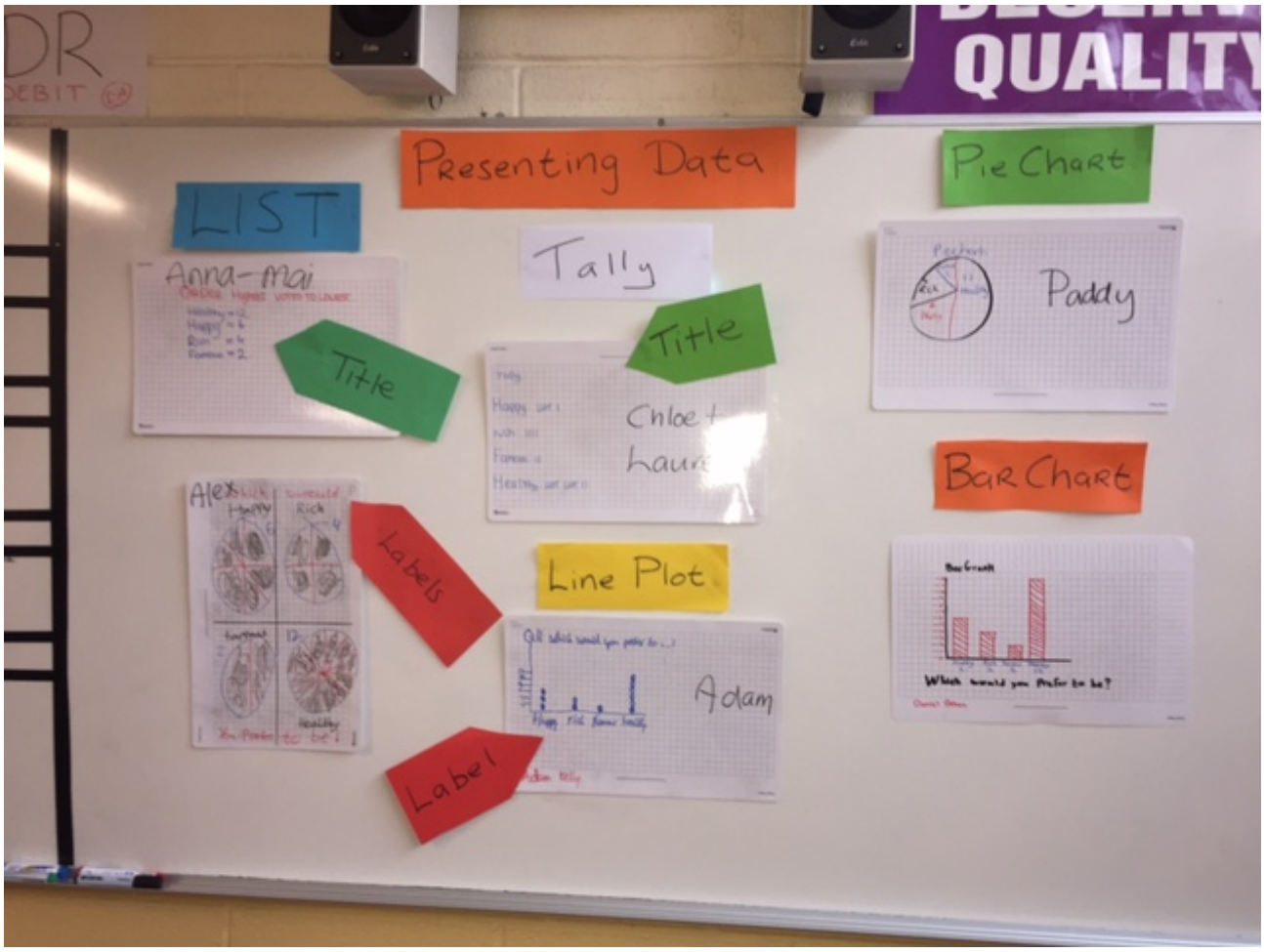
11. Board Plan

Board Plan of Anticipated Student Responses

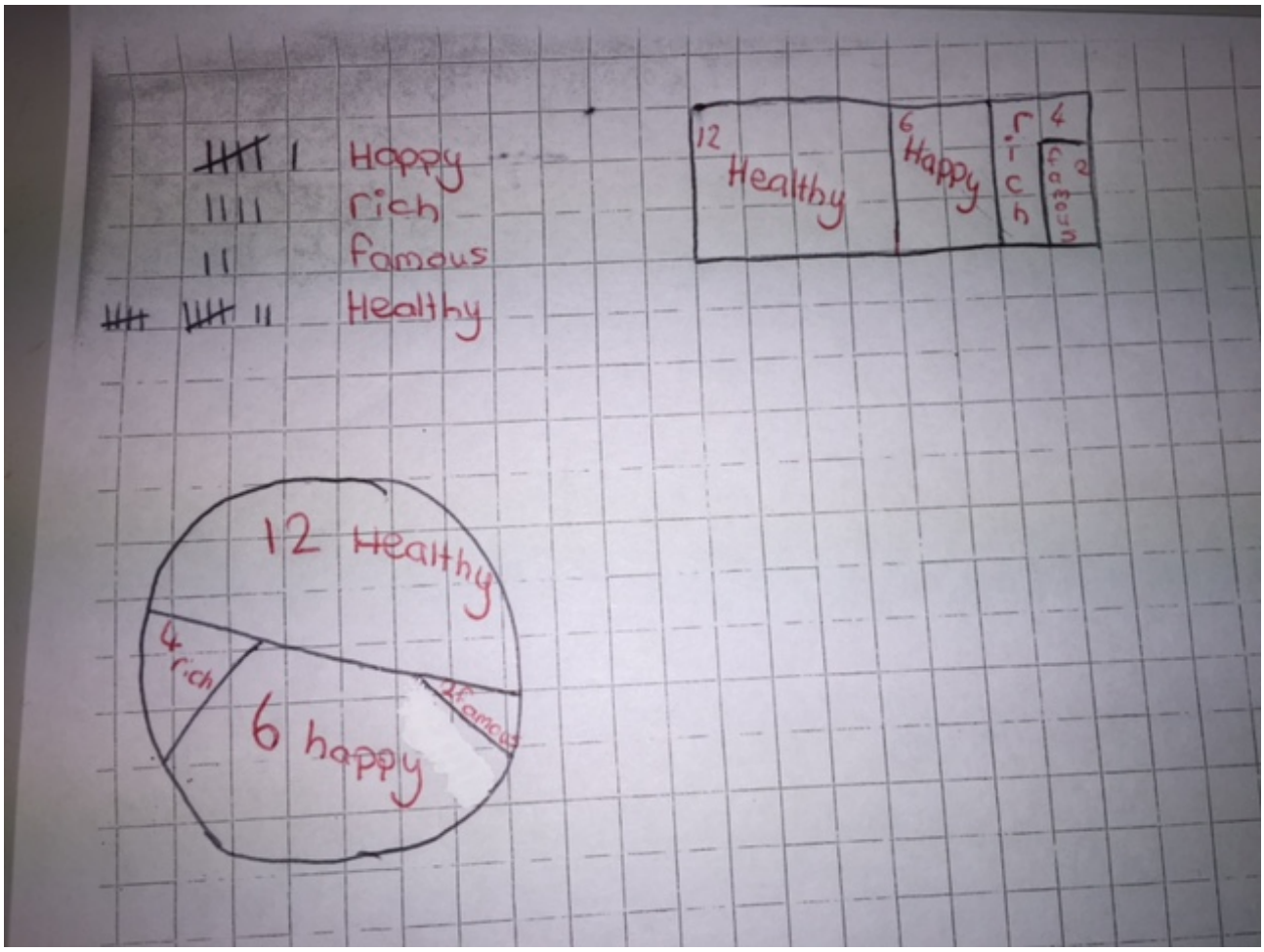
The Problem: Present this data for a local newspaper.



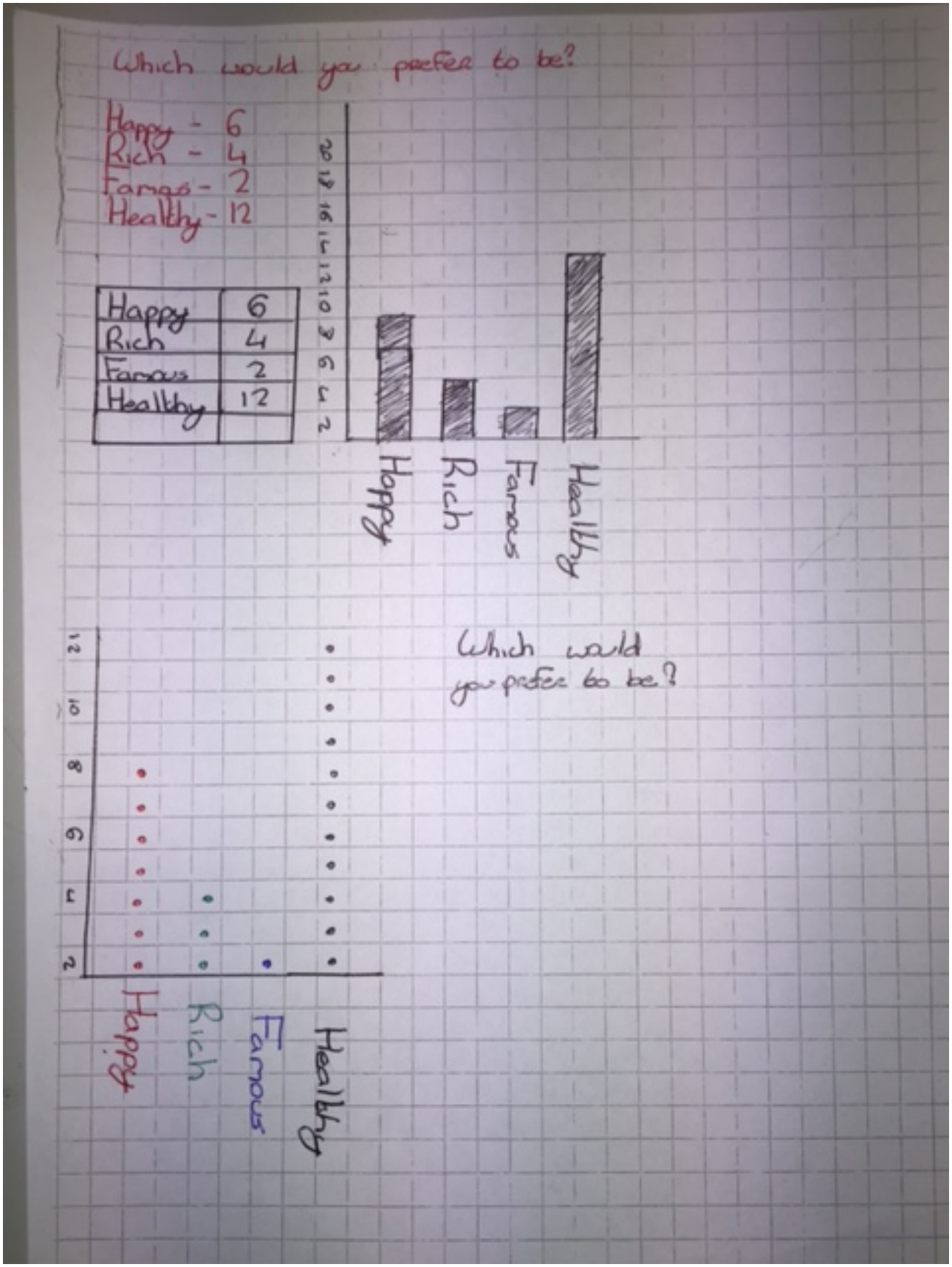
Board Plan of Student Responses



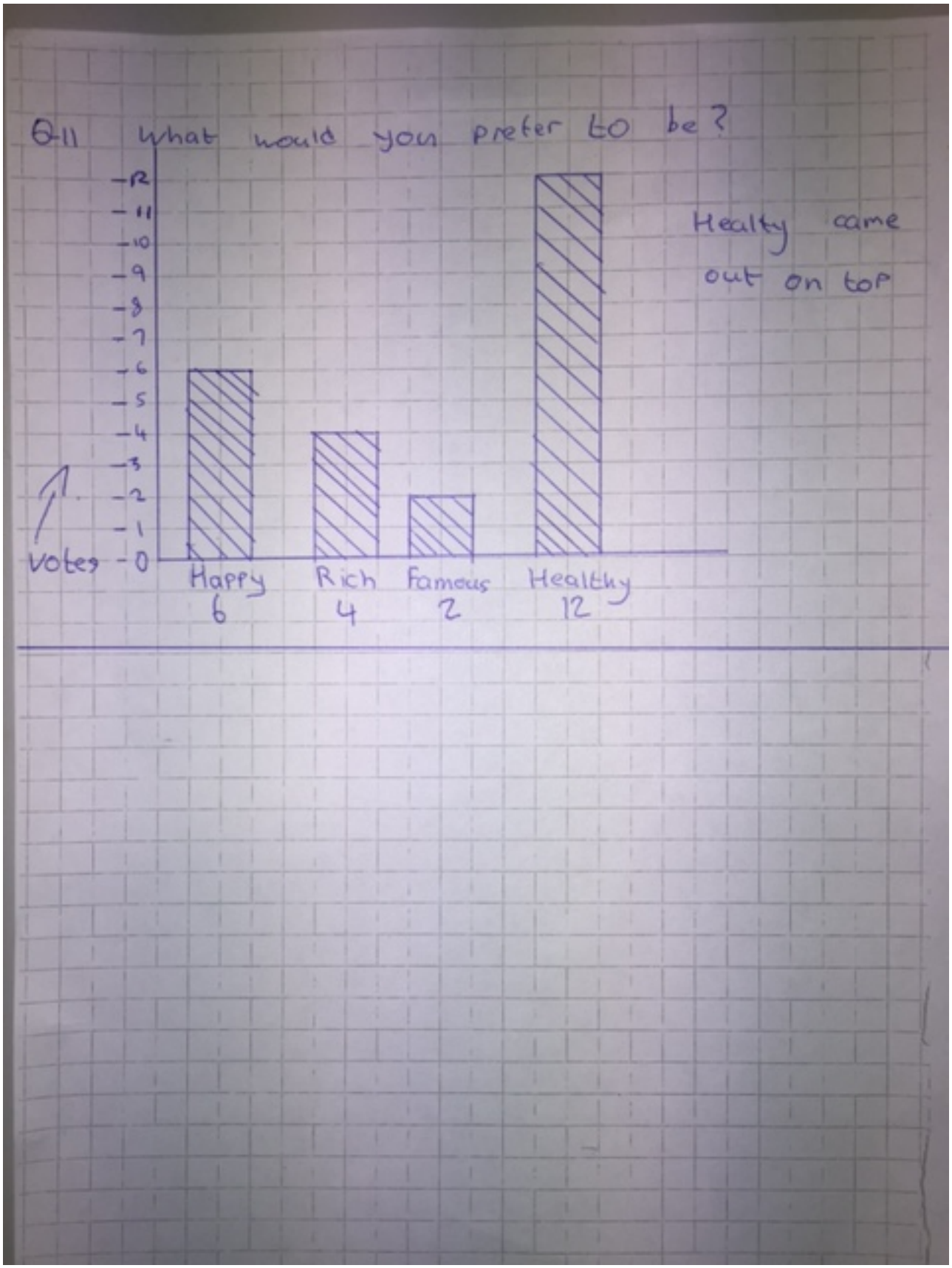
Sample of Student's Work: Image 1



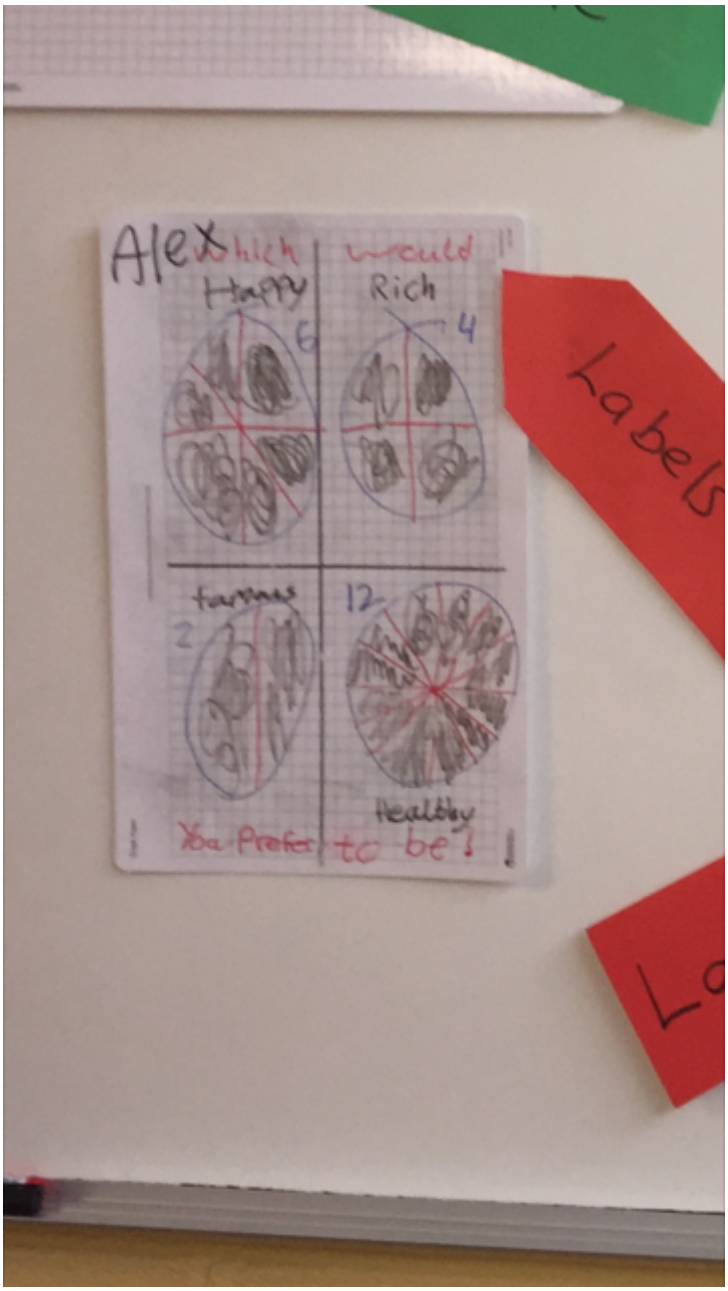
Sample of Student's Work: Image 2



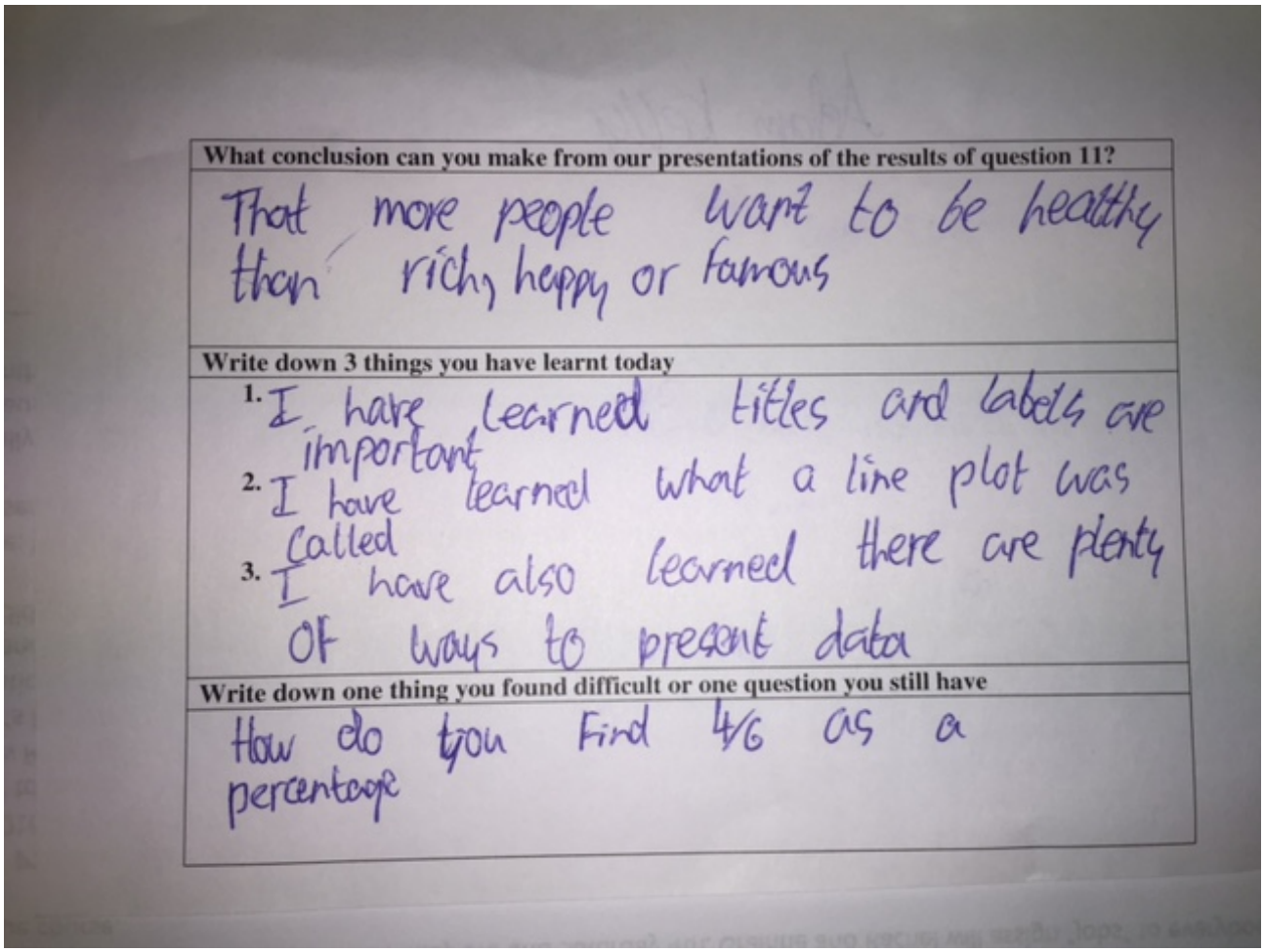
Sample of Student's Work: Image 3



Sample of Student's Work: Image 4



Sample of Student's Exit Slips: Exit Slip 1



What conclusion can you make from our presentations of the results of question 11?

That more people want to be healthy than rich, happy or famous

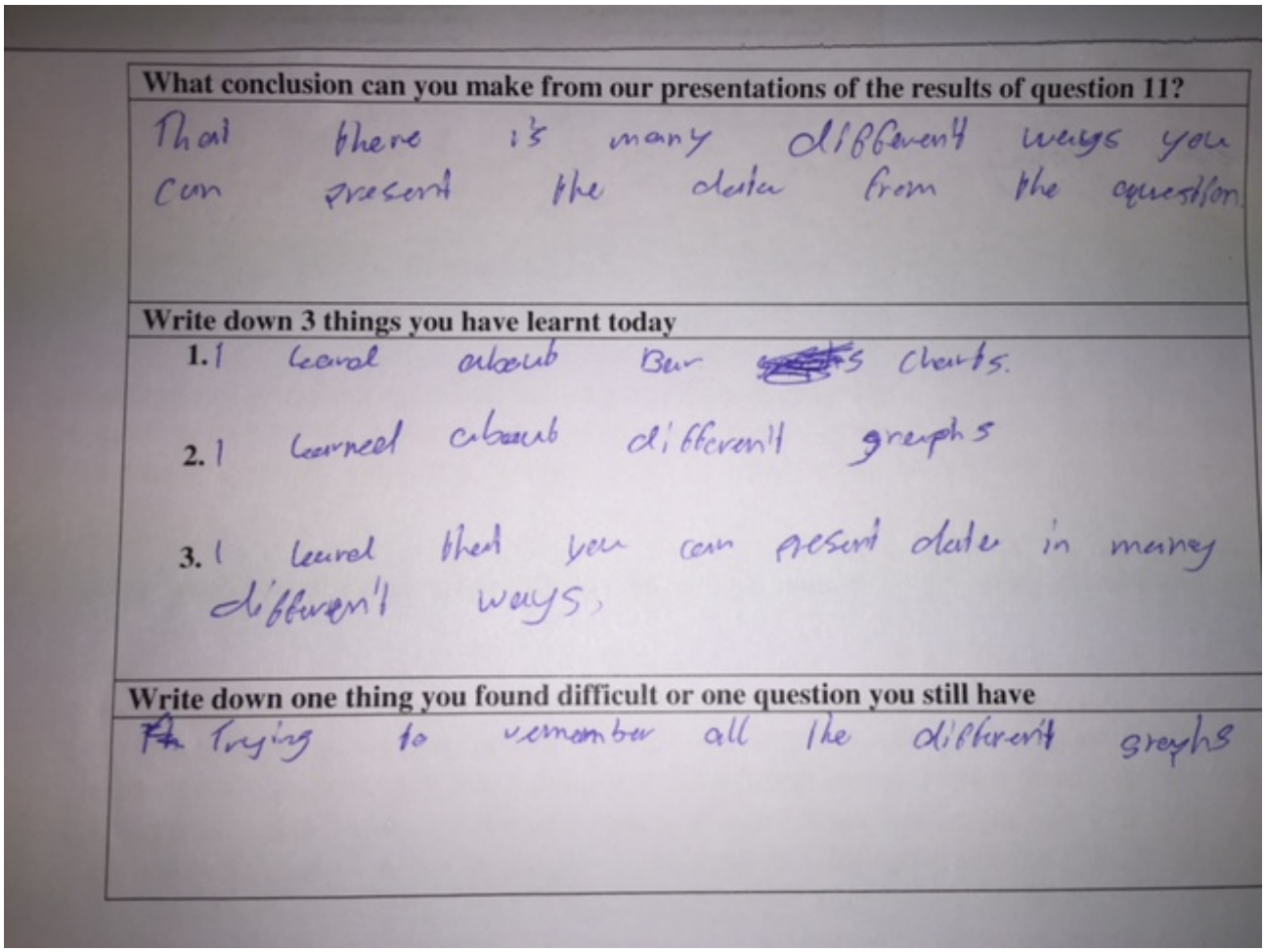
Write down 3 things you have learnt today

1. I have learned titles and labels are important
2. I have learned what a line plot was called
3. I have also learned there are plenty of ways to present data

Write down one thing you found difficult or one question you still have

How do you find 4/6 as a percentage

Sample of Student's Exit Slips: Exit Slip 2



What conclusion can you make from our presentations of the results of question 11?

That there is many different ways you can present the data from the question.

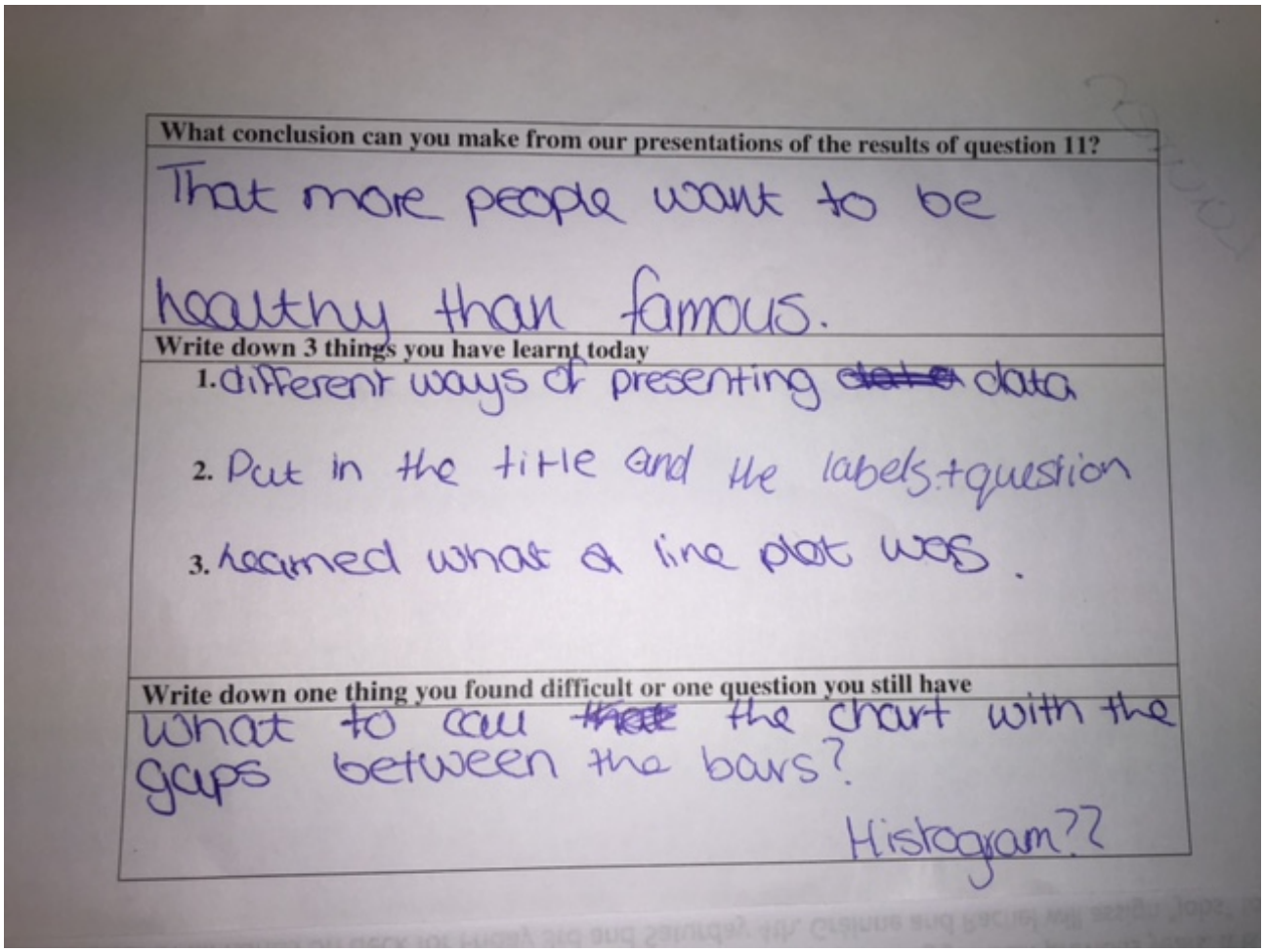
Write down 3 things you have learnt today

1. I learnt about Bar [illegible]s charts.
2. I learned about different graphs
3. I learnt that you can present data in many different ways.

Write down one thing you found difficult or one question you still have

~~I'm~~ Trying to remember all the different graphs

Sample of Student's Exit Slips: Exit Slip 3



What conclusion can you make from our presentations of the results of question 11?

That more people want to be healthy than famous.

Write down 3 things you have learnt today

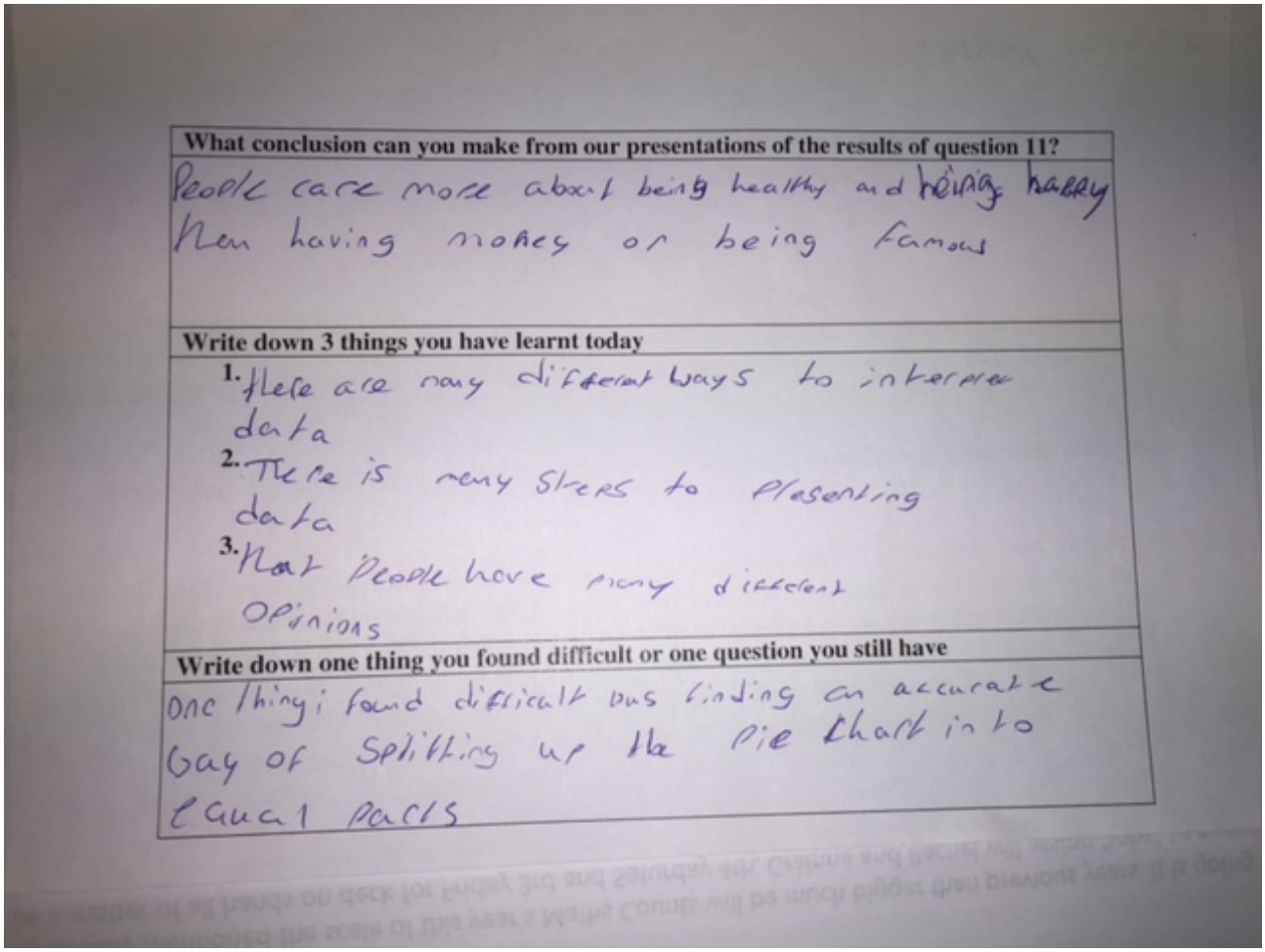
1. different ways of presenting ~~data~~ data
2. Put in the title and the labels + question
3. learned what a line plot was.

Write down one thing you found difficult or one question you still have

What to call ~~that~~ the chart with the gaps between the bars?

Histogram??

Sample of Student's Exit Slips: Exit Slip 4



What conclusion can you make from our presentations of the results of question 11?
People care more about being healthy and being happy than having money or being famous
Write down 3 things you have learnt today
1. There are many different ways to interpret data 2. There is many steps to Presenting data 3. That People have many different opinions
Write down one thing you found difficult or one question you still have
One thing i found difficult was finding an accurate way of Splitting up the Pie chart into equal parts

12. Post-lesson reflection

What are the major patterns and tendencies in the evidence? Discuss

The students the teacher (Shauna) anticipated to participate in the lesson engaged with the task very well. One major pattern was that the majority of students presented data graphically, few students presented data numerically. The most common graph was the bar chart as anticipated by the group. Accuracy and precision was limited which was also a factor considered by the group during the Meitheal Machnaimh process of Lesson Study.

What are the key observations or representative examples of student learning and thinking?

Some students were slow to begin the task while others completed 5 presentations within the Kikanshido (problem solving) process. No students needed further clarification on the posed task. Upon reflection, the group feels their initial slow start was due to the presence pf extra teachers in the room. Students demonstrated a strong prior knowledge of the data handling cycle from the previous two lessons. Students were proud of their work and content for photos of their presentations to be taken, highlighting their confidence and clarity with the task.

What does the evidence suggest about student thinking such as their misconceptions, difficulties, confusion, insights, surprising ideas, etc.?

Evidence suggests that no students were confused with the task or had any difficulties. Surprising ideas included the area representation (see sample of student's work: image 1), inaccurate pie chart (see sample of student's work: image 1), a student's unique representation (see sample of student's work: image 4). A distinct lack of numeracy skills – fractions, decimals, percentages was observed. No student presented data using number. This may be due to the position of the Lesson Study in the flow of the unit. There was gender equality in the presentation of graphs to the class. The exit slips acted as formative assessment as students articulated what they had learning during the lesson and demonstrated whether the learning outcomes had been achieved.

In what ways did students achieve or not achieve the learning goals?

Learning Outcome 1: represent data graphically.
This was achieved by all students.

Learning Outcome 2: appreciate the necessities for precision so that graphs are clearly presented.
This learning outcome was achieved by some on their own merit but by the end of the lesson all students appreciated the need for rules, compasses, titles, labels ect. The omission of titles and labels was overcome by constant questioning by teacher.

Learning Outcome 3: acknowledge how different graphs can be used to represent the same information.
A surprisingly large amount of the class realised that the same information could be presented in several different ways.

Learning Outcome 4: infer knowledge or draw conclusions from the graphs
While students could draw simple conclusions from the presentations there was no deep exploration as to why one graph may be more beneficial over another. It was decided to that the inference could be explored more:

- Get the students to decide which graph is the best and why
- Ask the students which graph do they prefer and why
- What is good and not so good about each graph.
- These questions can be discussed in a later class.

Based on your analysis, how would you change or revise the lesson?

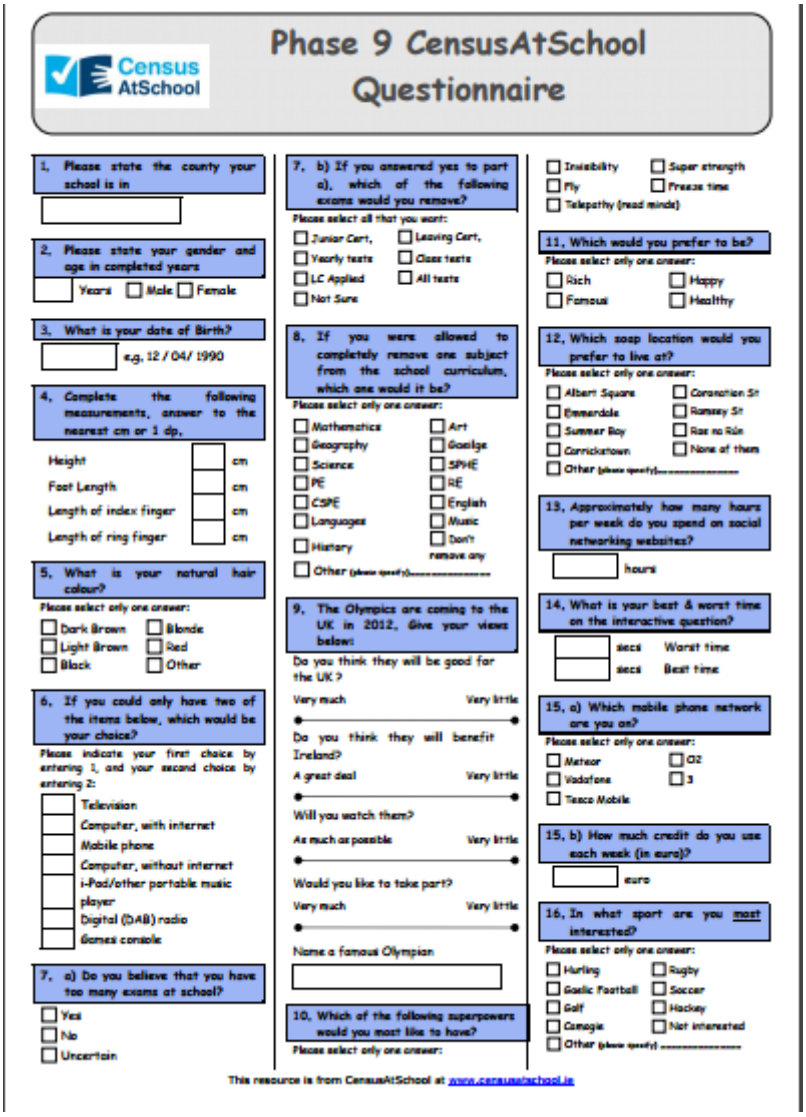
Going forward the students should identify problems with the presentation and solve them or rectify them immediately. We identified problems/omissions with students' work using coloured labels e.g title, but we should have asked the student to actually write in the title. Learning outcome 4 was not achieved due to the time constraints of the lesson however if the lesson was taught to a second year higher level group higher quality work would be expected, more questions would be anticipated and a deeper exploration of inferential statistics would occur. This lesson with learning outcomes 1-3 is suitable for a 1st year group.

What are the implications for teaching in your field?

We as teachers have the opportunity to continue to learn from our students, for example the representation through area. We do not give students enough credit for their ability to engage with a problem independent and arrive at meaningful solutions. Students are enjoying exploring this topic further as the Lesson Study provided a solid foundation for them to make connections between their previous knowledge and new content they construct through Ceardaíocht.

Appendix 1: CensusAtSchool Phase 9 Questionnaire

http://www.censusatschool.ie/en/take-part/questionnaires/phase-9



Phase 9 CensusAtSchool Questionnaire

Census AtSchool

1. Please state the county your school is in

2. Please state your gender and age in completed years
Years Male Female

3. What is your date of Birth?
e.g. 12 / 04/ 1990

4. Complete the following measurements, answer to the nearest cm or 1 dp.
Height cm
Foot Length cm
Length of index finger cm
Length of ring finger cm

5. What is your natural hair colour?
Please select only one answer:
Dark Brown Blonde
Light Brown Red
Black Other

6. If you could only have two of the items below, which would be your choice?
Please indicate your first choice by entering 1, and your second choice by entering 2:
Television
Computer, with internet
Mobile phone
Computer, without internet
i-Pod/other portable music player
Digital (DAB) radio
Games console

7. a) Do you believe that you have too many exams at school?
Yes
No
Uncertain

7. b) If you answered yes to part a), which of the following exams would you remove?
Please select all that you want:
Junior Cert, Leaving Cert,
Yearly tests Class tests
LC Applied All tests
Not Sure

8. If you were allowed to completely remove one subject from the school curriculum, which one would it be?
Please select only one answer:
Mathematics Art
Geography Gaeilge
Science SPHE
PE RE
CSPE English
Languages Music
History Don't remove any
Other

9. The Olympics are coming to the UK in 2012. Give your views below:
Do you think they will be good for the UK ?
Very much — Very little
Do you think they will benefit Ireland?
A great deal — Very little
Will you watch them?
As much as possible — Very little
Would you like to take part?
Very much — Very little
Name a famous Olympian

10. Which of the following superpowers would you most like to have?
Please select only one answer:
Invisibility Super strength
Fly Freeze time
Telepathy (read minds)

11. Which would you prefer to be?
Please select only one answer:
Rich Happy
Famous Healthy

12. Which soap location would you prefer to live at?
Please select only one answer:
Albert Square Coronation St
Emmerdale Ramsey St
Summer Bay Ros na Rún
Carrickstown None of them
Other

13. Approximately how many hours per week do you spend on social networking websites?
hours

14. What is your best & worst time on the interactive question?
secs Worst time
secs Best time

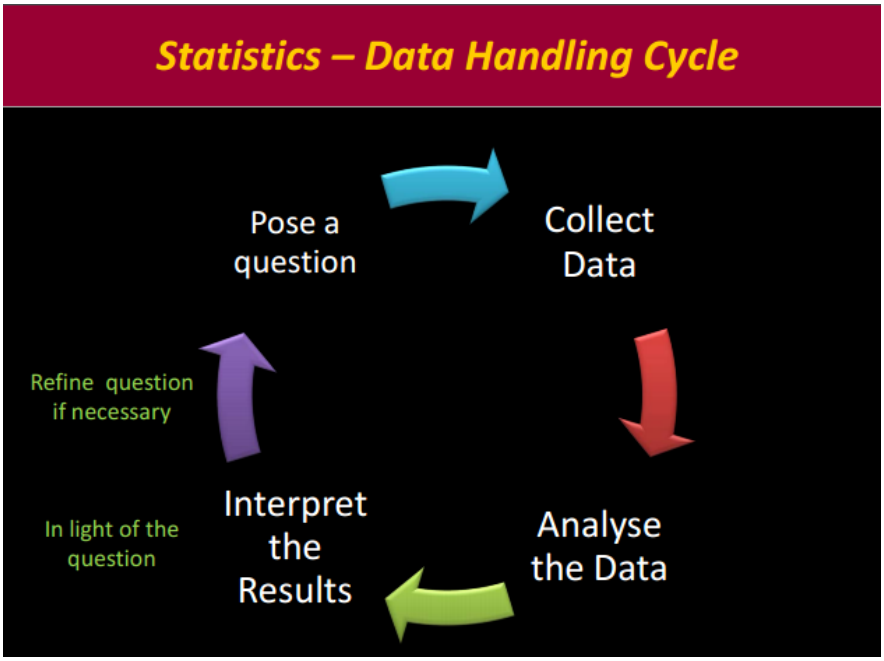
15. a) Which mobile phone network are you on?
Please select only one answer:
Meteor O2
Vodafone 3
Tesco Mobile

15. b) How much credit do you use each week (in euro)?
euro

16. In what sport are you most interested?
Please select only one answer:
Hurling Rugby
Gaelic Football Soccer
Golf Hockey
Camogie Not interested
Other

This resource is from CensusAtSchool at www.censusatschool.ie

Appendix 2: Data Handling Cycle



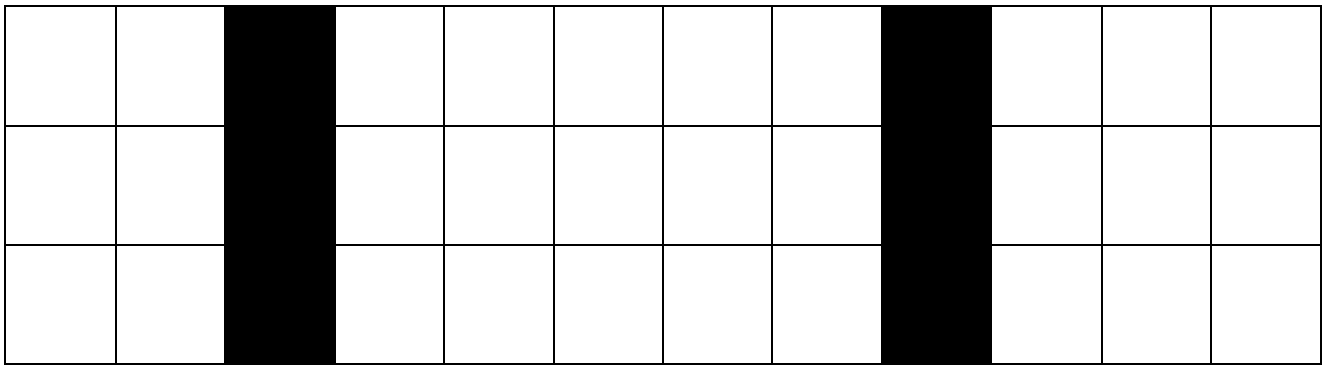
Appendix 3- Structured Problem: Present the Results of Question for the Local Newspaper

Appendix 4 – Exit Slip

What conclusion can you make from our presentations of the results of question 9?
Write down 3 things you have learnt today
1. **2.** **3.**
Write down one thing you found difficult or one question you still have

Appendix 5: Seating Plan

Front of Room



Appendix 6: Lesson Observation Document

Observation of student responses	Student 1	Student 2	Student 3	Student 4	Student 5	Student 6
Did the student understand what was being asked of him/her?						
Problem encountered in presenting data						
Non graphic presentation						
Graphic presentation type						
Completion of exit slip						

Were the students engaged throughout the lesson? **1-Very little engagement** **2-Some engagement** **3-Engaged** **Comment on any other observations e.g questions asked, interactions with others, participation with discussions**	**Student 1**	**Student 2**	**Student 3**	**Student 4**	**Student 5**	**Student 6**
What changes do you think need to be made to the lesson plan?						
Did you notice any problems that could possibly arise again in future classes that may limit understanding of the topic?						