Workforce Diversity

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Year 10 CoRE

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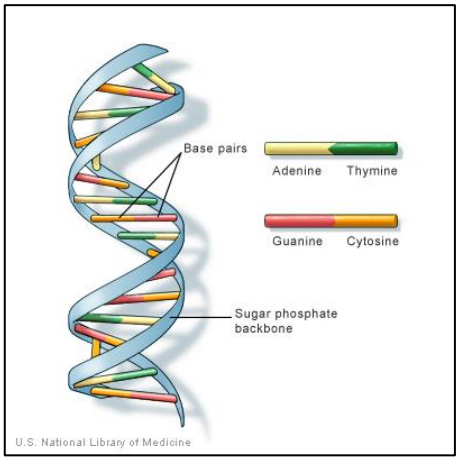
Contents

1. Introduction

1.1 Key Concepts

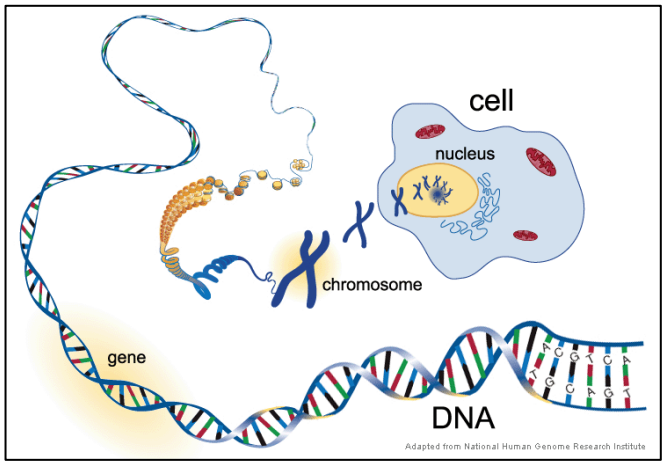
DNA

Deoxyribonucleic Acid, or DNA, is a molecule that exists within every organism that contains all of the necessary information in order for the organism to develop, reproduce and survive. DNA appears in a twisted ladder like shape known as a double helix. The vertical sides of the helix are made up of sugar and phosphate molecules. Attached to the sugar are a pair of one of four nitrogen bases: adenine (A), thymine (T), guanine (G) and cytosine (C). In normal DNA, adenine and thymine pair together and guanine and cytosine pair together. If these bases pair incorrectly, a genetic mutation will occur. The order of the pairing of these bases makes up the genes.



Picture 1: This diagram shows the structure of DNA

Genes are the language of the cell, which tell the body how to create proteins. The variation in their combination is what defines us as human being and makes us unique. Genes vary in size and can be made up of anywhere between a few hundred to more than two million nitrogenous bases.



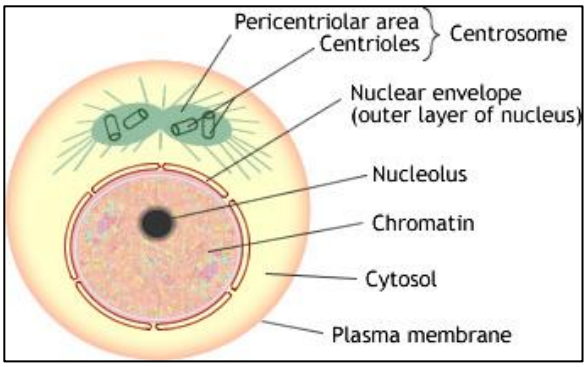
Picture 2: This diagram shows how DNA, genes and chromosomes all fit together

In order to fit into cells, DNA coils tightly into chromosomes. These chromosomes are found in the nucleus of the cell, and contain a single DNA molecule. Humans have 46 chromosomes (23 pairs), 44 of which are autosomal chromosomes and 2 which are sex chromosomes. Autosomal chromosomes are responsible for appearance and function of the body, while sex chromosomes are responsible for determining whether or not the organism is male or female. These two sex chromosomes could be either an X chromosome or a Y chromosome. If one sex chromosome is an X and the other is a Y, then the organism is male. If both sex chromosomes are X, then the organism is female. The sex chromosome combination YY is impossible in humans, and any offspring with this combination would be naturally aborted.

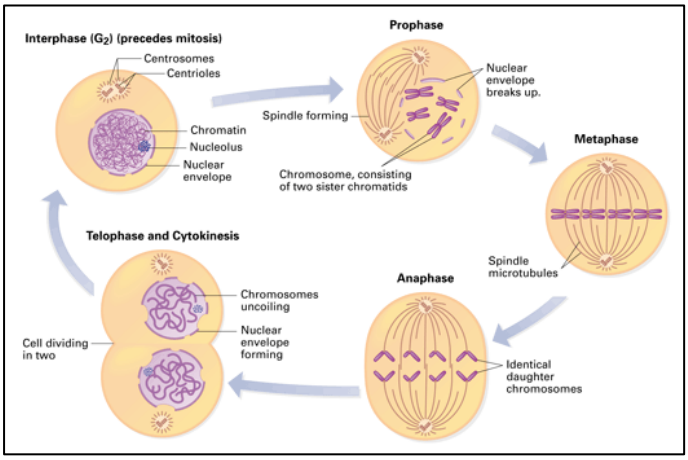
Mitosis and Meiosis

Mitosis and Meiosis are two methods of cellular reproduction.

Mitosis, or asexual reproduction, is the oldest form of reproduction. In mitosis, the cells undergo cellular division to produce more cells. When the cell is not dividing, the cell is on interphase. The process starts with one cell, known as the mother cell, and ends with two identical cells called daughter cells. There are four division phases of mitosis: prophase, metaphase, anaphase and telophase. In prophase, the centriole move to opposite poles of the cell then spindle fibres connect the two sets. Once this has happened, the spindle fibres attach to the chromosomes, which the DNA has been condensed into. The nuclear member then disappears and metaphase begins. The metaphase is when the chromosomes line up along the equator. This is then followed by anaphase, where the each of the 46 individual chromosomes are pulled into two halves and dragged to the two poles of the cell by the spindle fibres. The final phase of division is the division of the cell, the cytoplasm splits, resulting in two new cells. This form of reproduction is used for growth, development and repairs to the human body. It is used in the growth of hair and nails as well as when a cut is trying to repair itself.

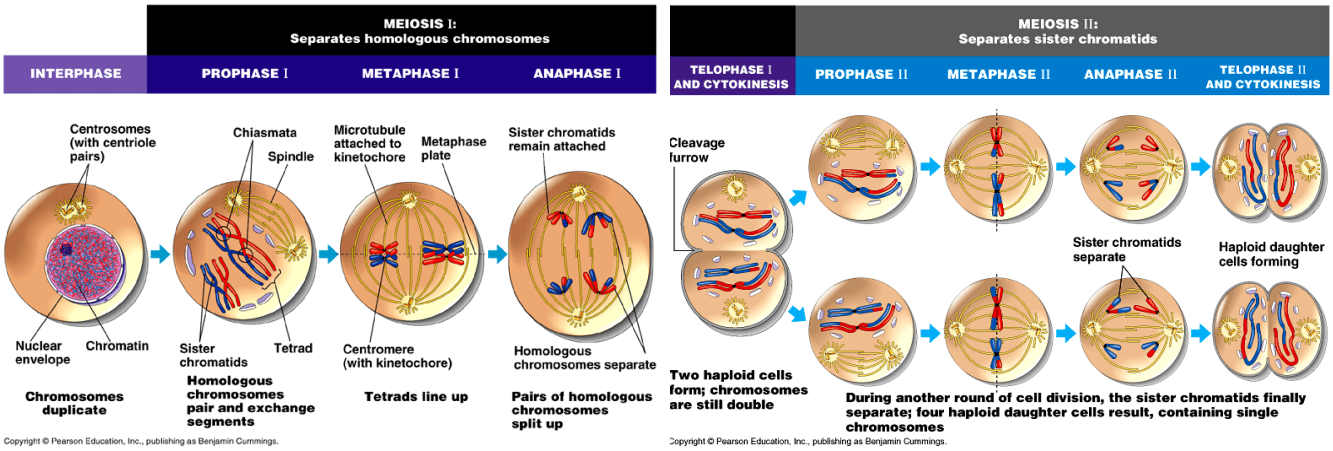


Picture 3: This diagram show the human cell in interphase



Picture 4: This diagram shows the process of mitosis

Meiosis, more commonly known as sexual reproduction, is the process of the halving of DNA before combining it with another set of DNA. The cells in meiosis are known as gametes. In females the gametes are the ova (eggs) and in males the gametes are the sperm. There are two stages in meiosis. The first stage, known as meiosis I, is the same as mitosis, with interphase, prophase, metaphase, anaphase and telophase all occurring in the same way. In meiosis II, the second stage, there is no interphase. Instead, the process begins with prophase. In the second stage of meiosis is carried out on the already separated chromosomes. The process of meiosis results in the production of four gametes.



Picture 5: This diagram show the process of meiosis

Genetics and Inheritance

All of our physical traits are controlled by our genes. We receive all of our genetic information from our parents; half from our mother and half from our father. The physical appearance of a certain trait of a human being is called the phenotype. The phenotype is influenced by what genetic information, also known as genotype, we have. Our genotype is controlled by the alleles which are carried on our genes. These alleles can be either dominant or recessive. If an allele is dominant, then that trait will be the phenotype. If an allele is recessive, then the trait is carried by the person, but not necessarily visible. When creating our phenotype, one allele from our mother and one allele from our father come together. These alleles combine to be either homozygous pair or heterozygous pair. A homozygous pair of alleles is a set of alleles that are both the same; either both dominant or both recessive. A heterozygous pair of alleles is the combination of both a dominant and a recessive allele.

An offspring could have one of four combinations of their parent's alleles. The possible outcomes can be worked out using a punnet square. For example, Figure 1.1 shows the possible outcomes of two heterozygous parents. In this case, the dominant allele, represented by T, is the ability to tongue roll. The recessive allele, represented by t, means unable to tongue roll.

Father

Mother	T	t
T	TT	Tt
t	Tt	tt

Figure 1.1: A punnet square of two heterozygous parents, where T is the ability to tongue roll and t is unable to tongue

From this punnet square we can see that there is a one in four chance the child will be homozygous dominant and will therefore be a tongue roller. We can see there is also a one in four chance of the child being heterozygous recessive, meaning they are unable to tongue roll. The other half of the chance is that the child will be heterozygous. If an offspring is heterozygous, the child shows the dominant allele, but also carried the recessive allele and has the potential to pass the recessive trait onto their offspring. In this case, the child has the ability to tongue roll, but also carries the gene for inability to tongue roll.

1.2 Purpose

The purpose of this investigation is to examine the genetic diversity that exists within a working environment.

1.3 Aim

The aim of this investigation is to observe how genes influence different traits of a human being.

2. Plan & Design

2.1 Investigation Set-Up

In order to analyse diversity within a workplace, the Oyster Catchers designed and conducted a survey on the members of the Year Ten CoRE class looking at aspects such as ethnicity and their genetic makeup. This would hopefully lead to discoveries of links between two aspects.

The survey was created using an online survey building tool called *Typeform*. *Typeform* was chosen because it was easy to use, displayed data effectively and looked professional. In order to build the survey, a series of questions were created to found out about the genetics as well as the racial background of the sample population. These questions were:

1. What is your gender?
2. What country were you born in?
3. What is your ethnicity?
4. What is your height in centimetres?
5. What is your weight to the nearest kilogram?
6. What is your natural hair colour?
7. What is your eye colour?
8. Do you require any visual aids? (e.g. glasses)
9. What is your blood type?
10. Do you have any health conditions? (e.g. Asthma, Allergies, etc.)

Following the build and design process set up by *Typeform*, the survey was constructed and ready to share with the participants.

The selected sample population was the Year Ten CoRE class. This class consisted of 30 students, with a mixture of both females and males. The students were aged either 15 or 16 years old. From observations prior to the investigation, it can be inferred that there is a large portion of students with a unique ethnic background.

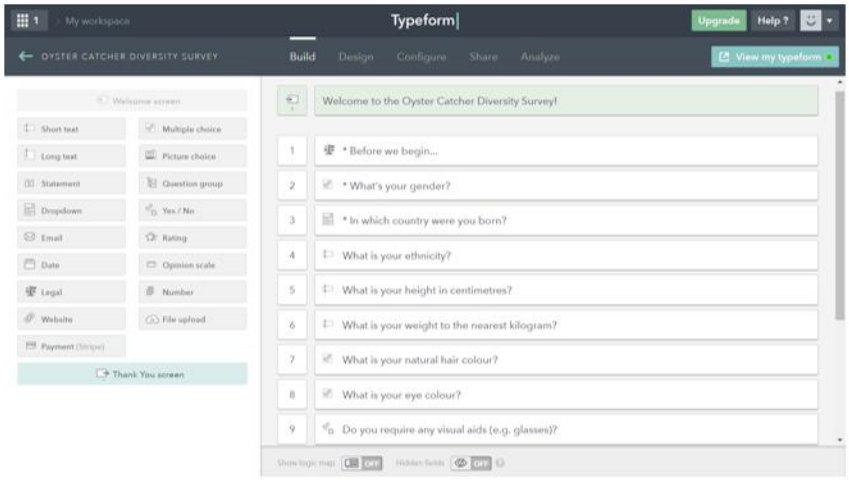
Questions for Survey

What is your ancestry?
What is the country of origin of your;
Mother?
Father?
Grandparents?

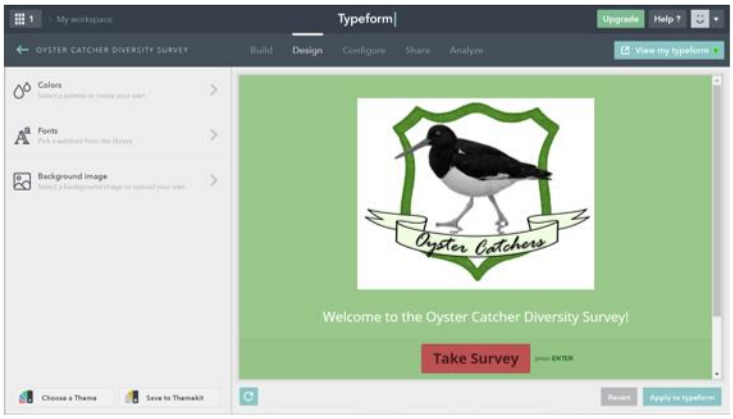
What country were you born in?

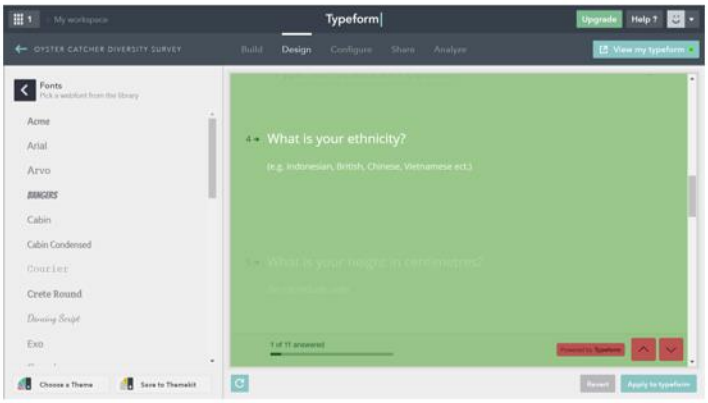
What is your:
Gender:
Height:
Age:
Weight:
Eye colour:
Hair colour:
Shoe size:
Do you require visual aids? (e.g. Glasses, contact lenses)
Blood type
Do you have any health conditions? (e.g. allergies, diabetes, asthma etc.)

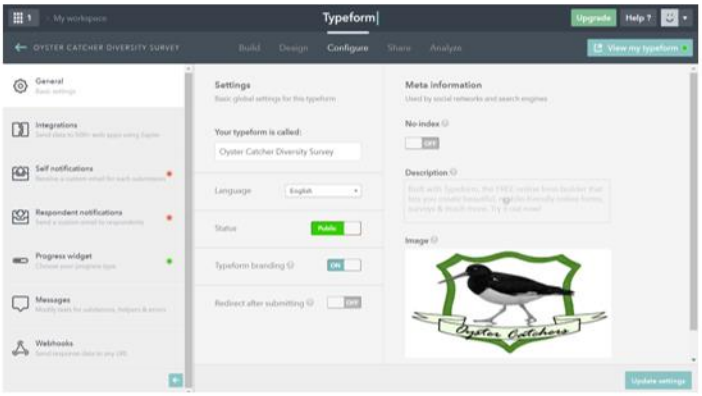
A series of questions were brainstormed and the best ones were put into the survey



The survey was designed to be user-friendly and modern







The settings were configured to make the survey easy to use and effective

Figure 2.1: This diagram shows the process of creating our survey

2.2 Table of Variables

Variables	Description
Controls (Same)	The control for this investigation were the questions asked in the survey. By asking the same questions to different people, we were able to observe the differences in the phenotype and ancestry of our chosen population.
Independents (Change)	The independent variable in this investigation is the number of people who respond to the survey and how well they complete it. The lack of data given from the respondents will affect the results.
Dependents (Measure)	The dependent in this investigation were the responses to the questions. The variations in answers for each of the questions became our data.

Figure 2.2: This table highlights all if the variables in our investigation

2.3 Hypothesis

Particular phenotypes will be more common in some races than others. Gender may also play a role in the determination of phenotypes.

3. Conducting

Once the survey was set-up, it was up to the students to complete it in order to gather our data.

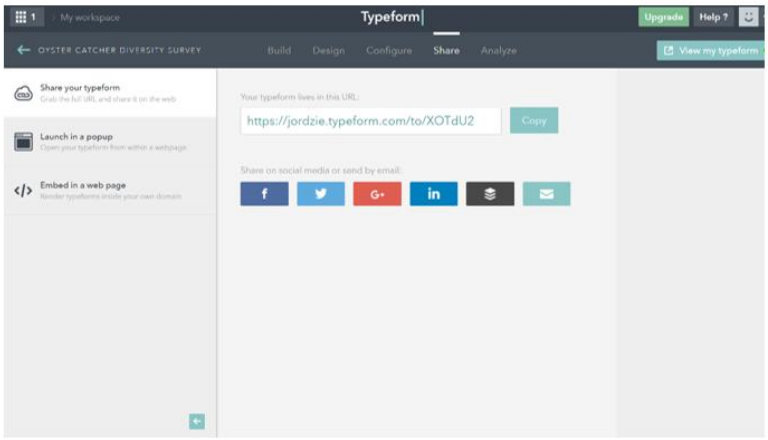
The survey was conducted over a period of three weeks. In these three weeks we got responses from all thirty members of our survey population. Unfortunately, there were a few people who were unable to answer some questions, meaning that there were a few pieces of data missing.

3.1 Table of Observations and Measurements

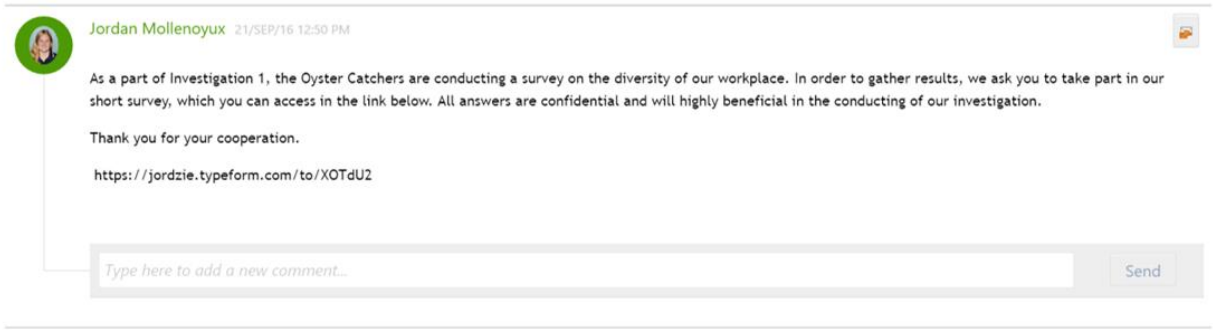
#	Before we	What's yo	Other	In which c	What is yc	What is yc	What is yc	What is yc	Other	What is yc	Other	Do you re	What is yc	Do you ha	Start Date	Submit Da	Network II
6cfb61473	1	Female		Australia	Australian	158	60	Blonde		Hazel		0	Unsure	No	2016-09-2	2016-09-2	f411903be
0ebca417f	1	Female		Australia	ummm... I	150cm		Blonde		Green		0	Unsure	nothing re	2016-09-2	2016-09-2	f411903be
588e023e4	1	Female		Indonesia	Indonesia	153	47	Brown		Brown		1	O	No	2016-09-2	2016-09-2	f411903be
46a899b6	1	Female		Papua Ne	Papua Ne		67-70	Brown		Black		0	O	No	2016-09-2	2016-09-2	f411903be
22c652a4(	1	Male		Australia	Australian	idk	idk	Black		Blue		0	Unsure	No	2016-09-2	2016-09-2	fd62623f3
36bb5f22(	1	Female		Australia	Australian	174.5	72.7	Brown		Brown		1	Unsure	nothing to	2016-09-2	2016-09-2	434972c55
9d52eff46	1	Female		Singapore	Chinese, M	160	46	Black		Black		1	O	No	2016-09-2	2016-09-2	990caa8ec
346c68ec4	1	Male		Australia		180	70	Brown		Hazel		0	Unsure		2016-09-2	2016-09-2	c4642d5e2
bf465a51e	1	Male		Australia	Australian	174	52	Brown		Blue		0	Unsure	No	2016-09-2	2016-09-2	f411903be
bbb46144	1	Female		Australia	British	175	65	Blonde			Blue and (	0	Unsure		2016-09-2	2016-09-2	cbf970681
afde81be3	1	Female		Malaysia	indian	156	56	Black		Black		0	A	yes nutella	2016-09-2	2016-09-2	cbf970681
81bfb8aa1	1	Female		Malaysia	Malaysian	160	55kg	Black		Black		0	O	NO.	2016-09-2	2016-09-2	cbf970681
77faa96f4	1	Female		Malaysia	Indian			Black		Brown		1	O		2016-09-2	2016-09-2	cbf970681
b9a95cb4(	1	Male		Argentina	Argentine			Brown		Brown		0	A		2016-09-2	2016-09-2	c82ae864b
c876d559	1	Female		Zimbabwe	Zimbabwe	168	60	Brown		Brown		0	Unsure	No	2016-09-2	2016-09-2	cbf970681
0215b00fb	1	Female		Brazil	Brazilian	170	62	Brown		Brown		1	A	No	2016-09-2	2016-09-2	cbf970681
8efbf7a99	1	Male		New Zeala	Samoan/N	193cm	110	Brown		Brown		1	B	idk	2016-09-2	2016-09-2	cbf970681
f7ba7ffcd2	1	Female		Germany	German	173	57	Blonde		Brown		1	Unsure		2016-09-2	2016-09-2	cbf970681
af8f741b5	1	Male		India	Indian	185	80	Black		Black		0	B	No	2016-10-1	2016-10-1	cbf970681
c5854c2a(	1	Male		Australia	Australian	idk	idk	Black		Blue		0	Unsure	IDK	2016-10-1	2016-10-1	cbf970681
93d19aec	1	Male		Australia	Australian	170	50	Brown		Blue		0	Unsure	No	2016-10-1	2016-10-1	cbf970681
558e86e9	1	Male		Australia	Australian	176	N/A	Brown		Hazel		1	Unsure	N/A	2016-10-1	2016-10-1	cbf970681
cd7ef54ab	1	Male		Australia	English	175	55	Red/Oran		Brown		0	Unsure	No	2016-10-1	2016-10-1	cbf970681
ab44e215	1	Male		Australia	Australian	179cm	55-57	Brown		Hazel		0	Unsure	No	2016-10-1	2016-10-1	cbf970681
2d3e1376	1	Male		India	indian	idk	idk	Black		Brown		0	A	Alergic to	2016-10-1	2016-10-1	cbf970681
680de7fa(	1	Male		Indonesia	Indonesia	166	55	Black		Brown		1	O	No	2016-10-1	2016-10-1	c8fda0033
8be9eff6e	1	Male		Somalia	somalian	190	62	Black		Black		0	Unsure		2016-10-1	2016-10-1	cbf970681
5aab370f4	1	Male		Australia	Indo-Chin	162	55kg	Black		Black		0	Unsure	Yes, to ha	2016-10-1	2016-10-1	cbf970681
e5898a0b	1	Male		Australia	British	180	70	Blonde		Green		0	Unsure	None	2016-10-1	2016-10-1	cbf970681
5aab370f4	1	Male		Australia	Indo-Chin	162	55kg	Black		Black		0	Unsure	Yes, to ha	2016-10-1	2016-10-1	cbf970681

Figure 3.1: This table show the raw data collected from the survey

3.2 Flowchart



The survey was shared with the class...



...And we started getting responses for our survey

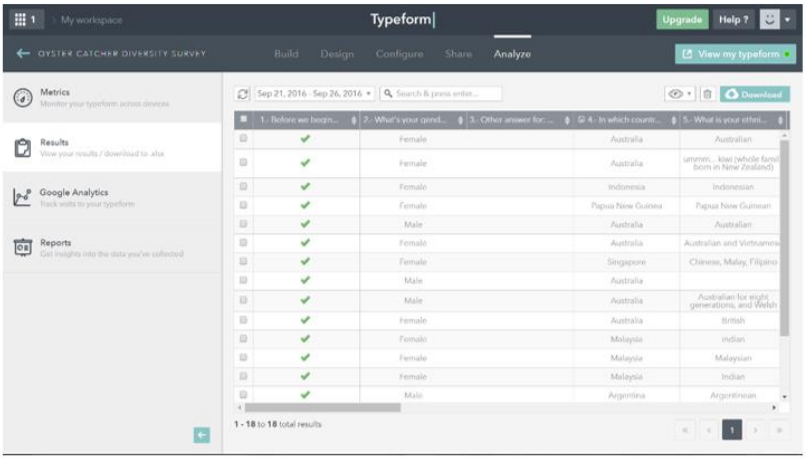


Figure 3.2: This diagram shows the process of sharing the survey and collecting of data

4. Processing

Gender	Country of Birth	Ethnicity	Height	Weight	Hair colour	Eye colour	Visual aids	Blood type	Health conditions
Female	Australia	Australian/French	158	60	Blonde	Hazel	No	Unsure	No
Female	Australia	New Zealand	150		Blonde	Green	No	Unsure	No
Female	Indonesia	Indonesian	153	47	Brown	Brown	Yes	O	No
Female	Papua New Guinea	Papua New Guinean		68	Brown	Black	No	O	No
Male	Australia	Australian			Black	Blue	No	Unsure	No
Female	Australia	Australian/Vietnamese	174.5	72	Brown	Brown	Yes	Unsure	No
Female	Singapore	Chinese/ Malay/Filipino	160	46	Black	Black	Yes	O	No
Male	Australia	Australian	180	70	Brown	Hazel	No	Unsure	No
Male	Australia	Australian/Welsh	174	52	Brown	Blue	No	Unsure	No
Female	Australia	British	175	65	Blonde	Blue and Green	No	Unsure	No
Female	Malaysia	Indian	156	56	Black	Black	No	A	Nutella
Female	Malaysia	Malaysian	160	55	Black	Black	No	O	No
Female	Malaysia	Indian			Black	Brown	Yes	O	No
Male	Argentina	Argentinean			Brown	Brown	No	A	No
Female	Zimbabwe	Zimbabwean	168	60	Brown	Brown	No	Unsure	No
Female	Brazil	Brazilian	170	62	Brown	Brown	Yes	A	No
Male	New Zealand	Samoan/Maori	193	110	Brown	Brown	Yes	B	No
Female	Germany	German	173	57	Blonde	Brown	Yes	Unsure	No
Male	India	Indian	185	80	Black	Black	No	B	No
Male	Australia	Australian			Black	Blue	No	Unsure	No
Male	Australia	Australian	170	50	Brown	Blue	No	Unsure	No
Female	Australia	Australian	176		Brown	Hazel	Yes	Unsure	No
Male	Australia	British	175	55	Red/Orange	Brown	No	Unsure	No
Male	Australia	Australian	179	56	Brown	Hazel	No	Unsure	No
Male	India	Indian			Black	Brown	No	A	Grass and animal fur (only if inhaled)
Male	Indonesia	Indonesian	166	55	Black	Brown	Yes	O	No
Male	Somalia	Somalian	190	62	Black	Black	No	Unsure	No
Male	Australia	Indonesian - Chinese	162	55	Black	Black	No	Unsure	No
Male	Australia	British	180	70	Blonde	Green	No	Unsure	No
Male	Australia	Indonesian - Chinese	162	55	Black	Black	No	Unsure	No

Figure 4.0: This table shows the raw data in a neat and organised table

4.1 Calculations

Height

Heights (cm)	Max	Min	Average	Median	Standard Deviation
150	193	150	170.5833	171.5	11.1874806
153					
156					
158					
160					
160					
162					
162					
166					
168					
170					
170					
173					
174					
175					
175					
175					
179					
180					
180					
180					
185					
190					
193					

Figure 4.1.1: This spreadsheet shows the results of calculations of mean average, median and standard deviation solved using Excel.

Weight

Weights (kg)	Max	Min	Average	Median	Standard Deviation
46	110	46	61.65217	57	13.14338549
47					
50					
52					
55					
55					
55					
55					
55					
56					
56					
57					
60					
60					
62					
62					
65					
68					
70					
70					
72					
80					
110					

Figure 4.1.2: This spreadsheet shows the results of calculations of mean average, median and standard deviation solved using Excel.

4.2 Tables of Averages

Heights (cm)
150
153
156
158
160
160
162
162
166
168
170
170
173
174
175
175
175
179
180
180
180
185
190
193
170.5833333

Figure 4.2.1: This table shows the average height of 24 out of 30 people who responded to the survey

Weights (kg)
46
47
50
52
55
55
55
55
55
56
56
57
60
60
62
62
65
68
70
70
72
80
110
61.65217391

Figure 4.2.2: This table shows the average weight of 23 out of 30 people who responded to the survey

4.3 Graphs

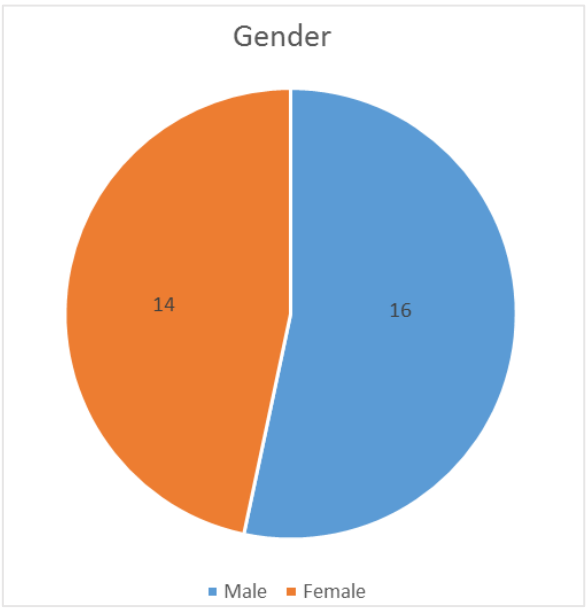


Figure 4.3.1: This graph shows the number of Males and Females in the sample population

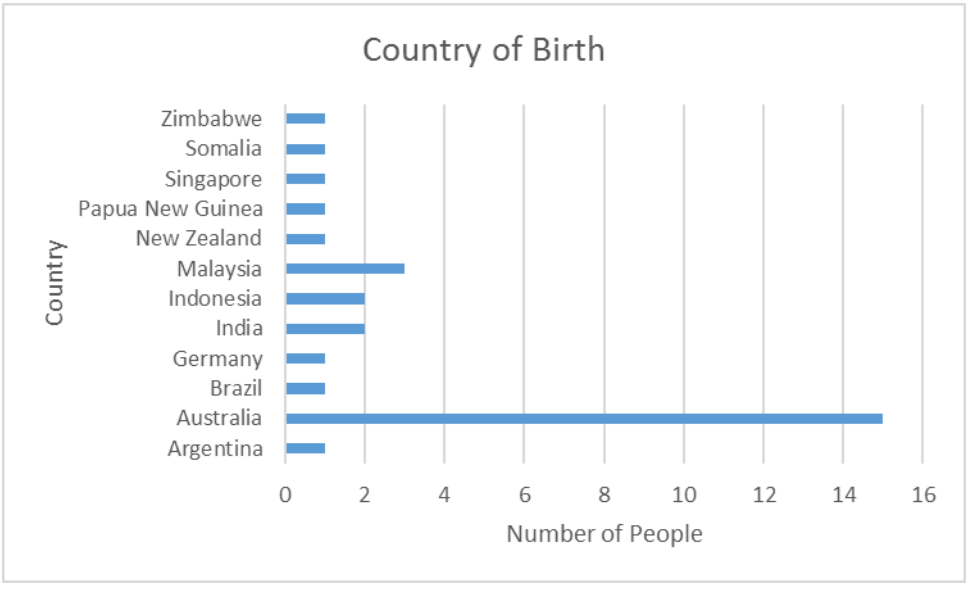


Figure 4.3.2: This graph shows the country of birth of the sample population

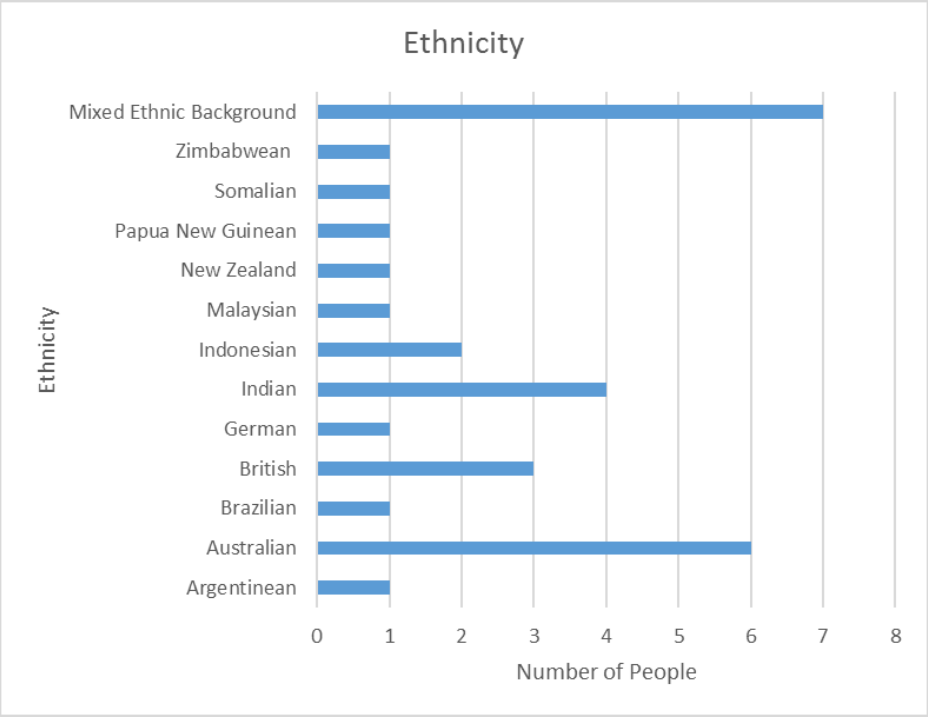


Figure 4.3.3: This graph shows the cultural background, or ethnicity, of the sample population

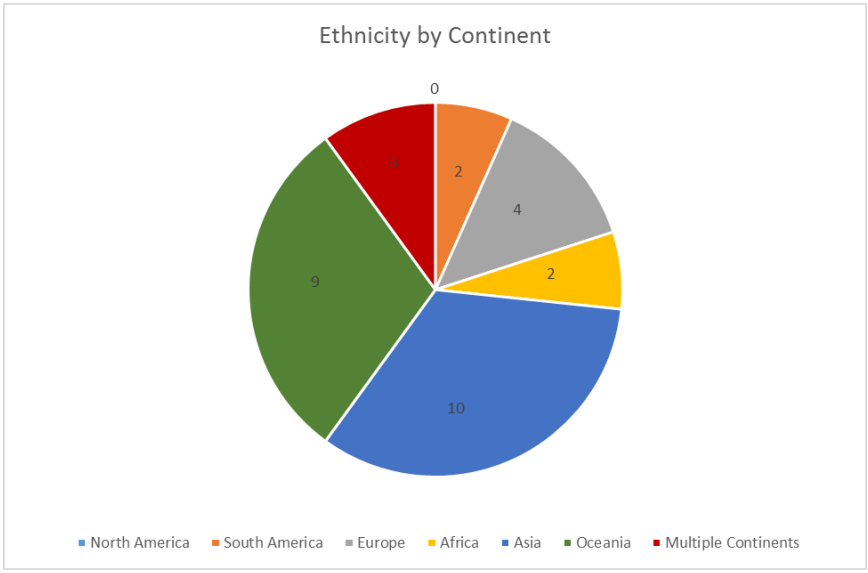


Figure 4.3.4: This graph shows the continent of origin (related to ethnicity) of the sample population

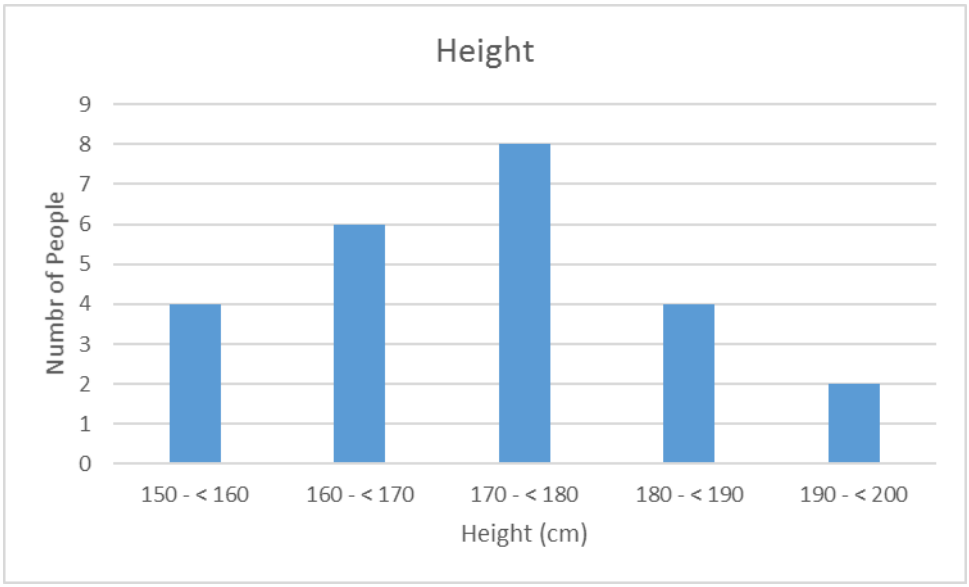


Figure 4.3.5: This graph shows the heights, in centimetres, of the sample population

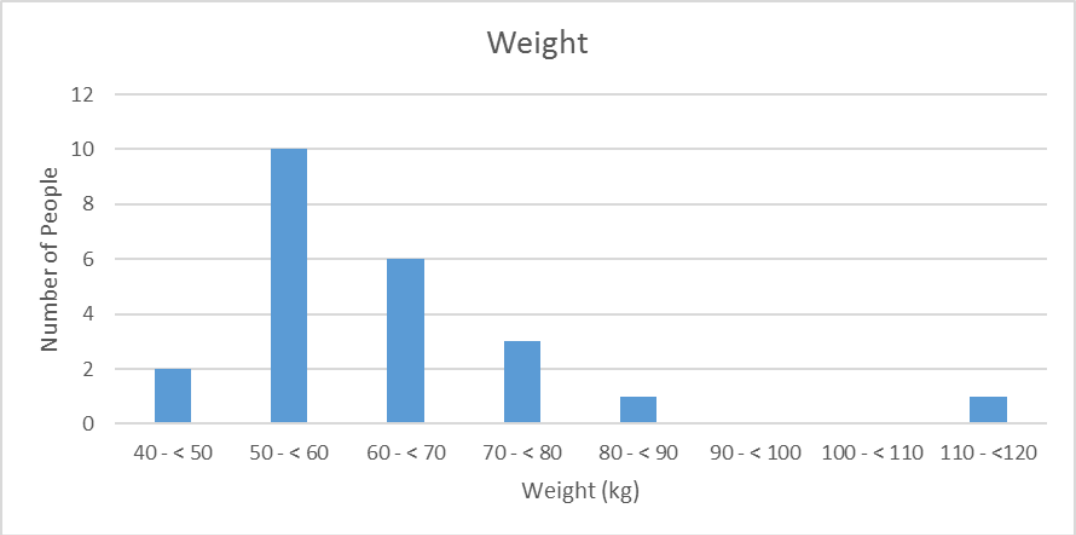


Figure 4.3.6: This graph shows the weights, in kilograms, of the sample population

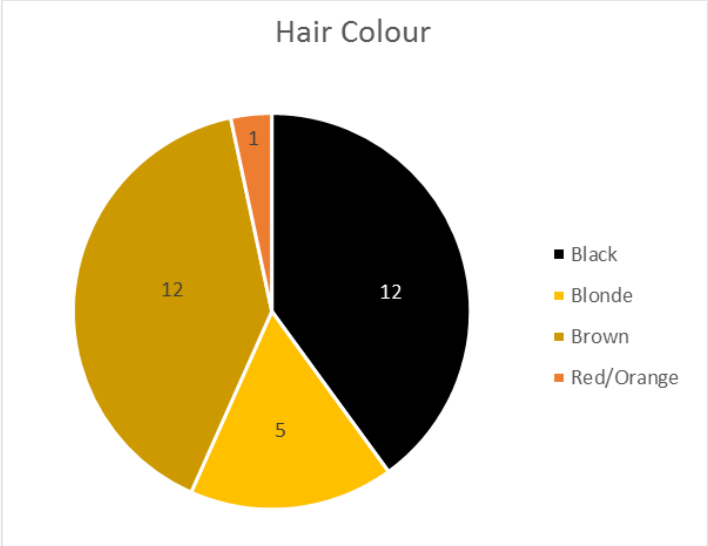


Figure 4.3.7: This graph shows the hair colour of the sample population

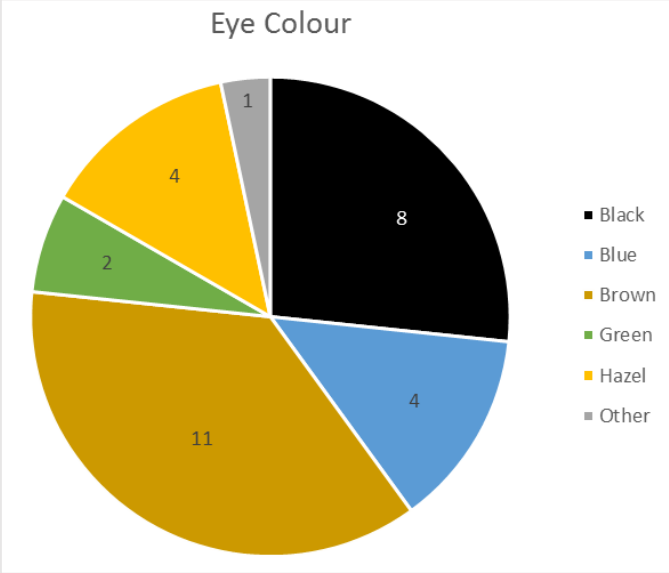


Figure 4.3.8: This graph shows the eye colour of the sample population

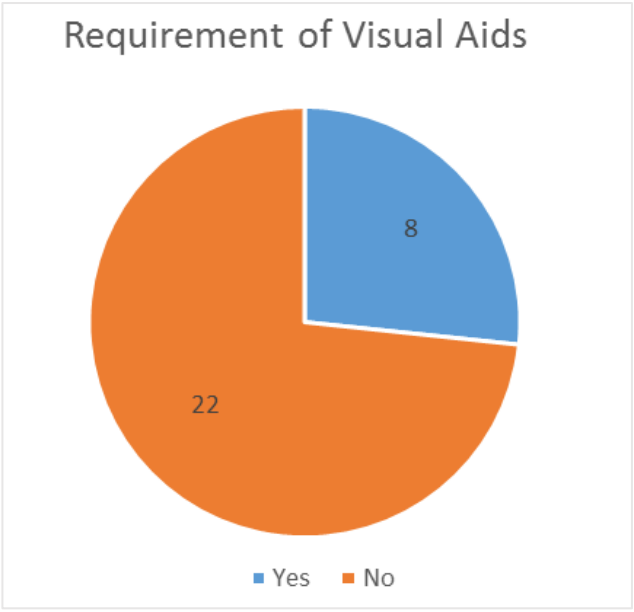


Figure 4.3.9: This graph shows the number of people who require visual aids (e.g. glasses) in the sample population

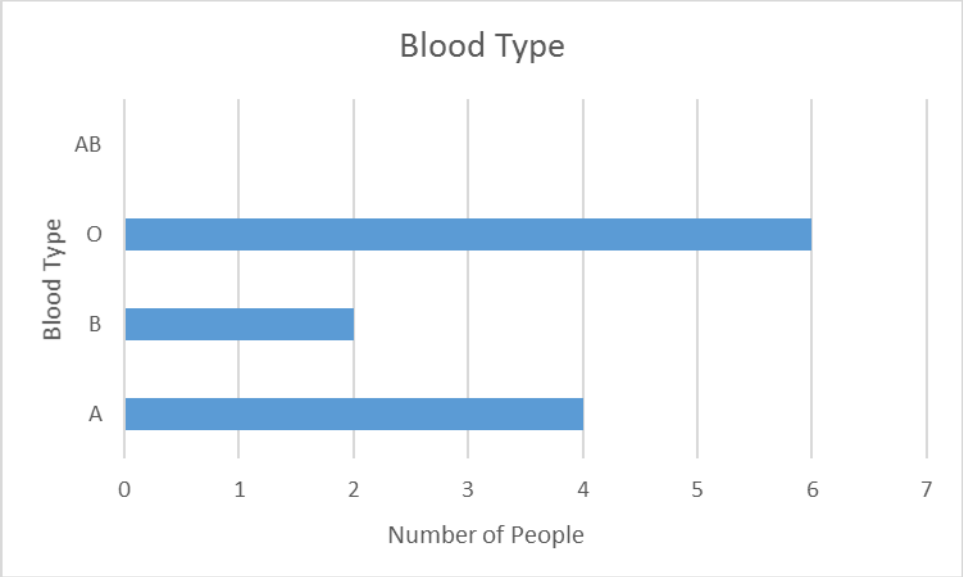


Figure 4.3.10: This graph shows the blood types of the sample population

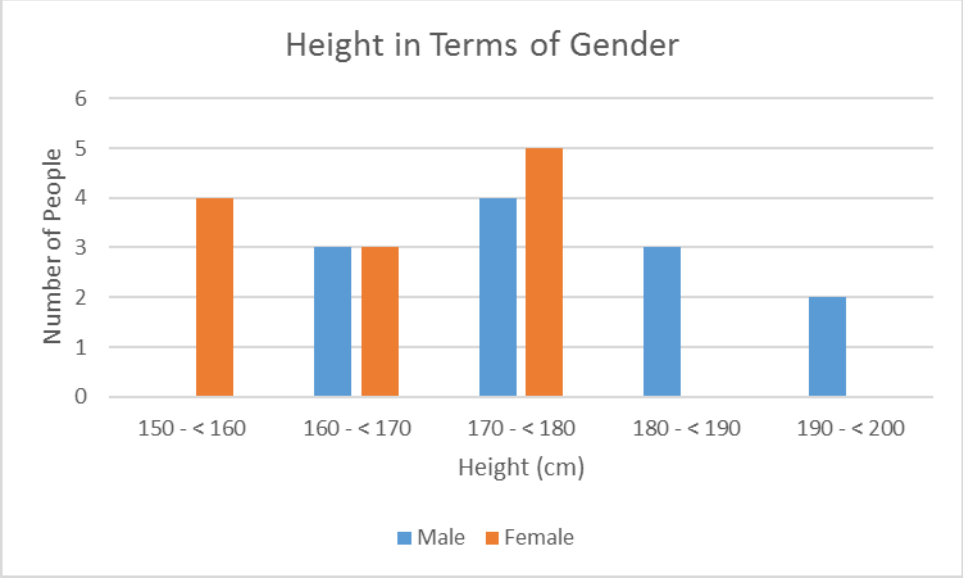


Figure 4.3.11: This graph shows the height in terms of gender of the sample population

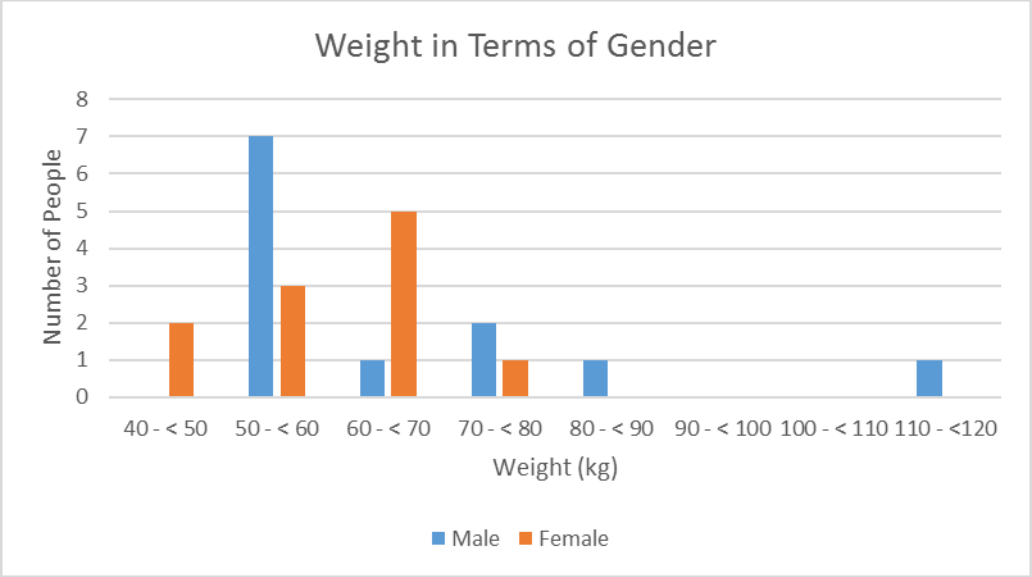


Figure 4.3.11: This graph shows the weight in terms of gender of the sample population

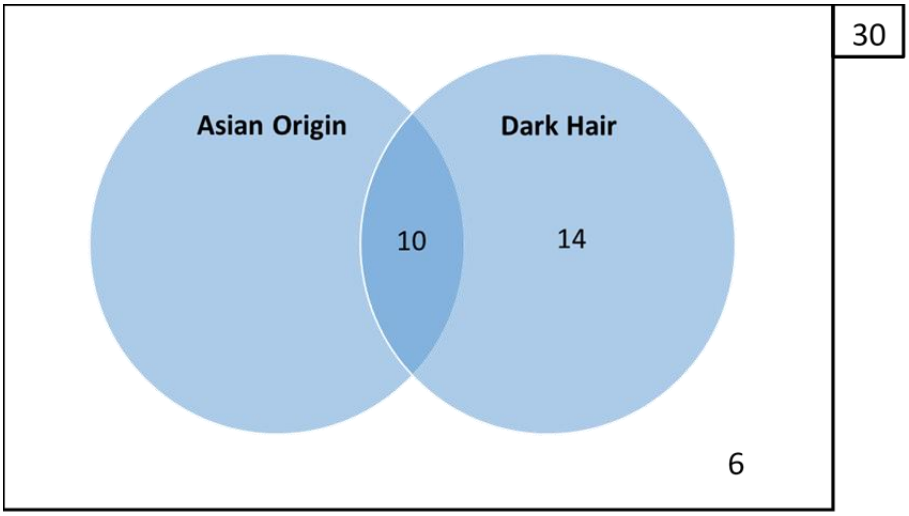


Figure 4.3.12: This Venn Diagram shows the number of people of Asian origin, have dark hair, are both or are neither of the sample population

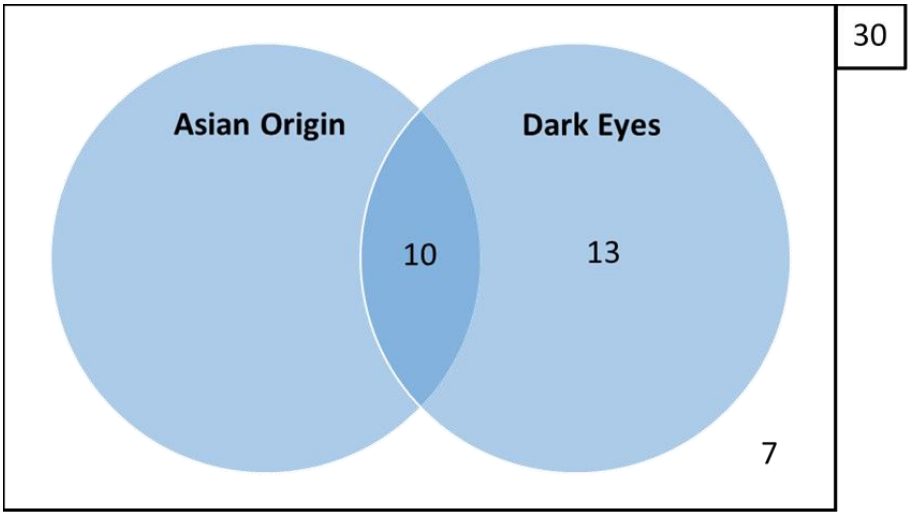


Figure 4.3.13: This Venn Diagram shows the number of people of Asian origin, have dark eyes, are both or are neither of the sample population

4.4 Discussion of Results

From this survey, there is evidence to support the theory that certain phenotypes are more common in particular races and that sex also plays a role the determination of phenotypes.

The results show that out of the sample population of thirty, fourteen of the students were female and sixteen of them male (Figure 4.3.1). Half of the population was born in Australia, while remaining half were born in one of twelve other countries (Figure 4.3.2). The sample population also has a diverse ethnic background, with origins spanning over 12 different countries (Figure 4.3.3) and 6 continents (Figure 4.3.4). The height of the population ranges from 153 cm to 192 cm, with the average height being 170.58 cm (Figure 4.1.1). The average weight of the sample population is 61.65 kg, ranging between 46 kg and 110 kg (Figure 4.1.1). The most dominant hair colours of the sample population were black and brown. One member of the population had red/orange hair, which is a rare genetic mutation (Figure 4.3.7). The most dominant eye colour in the sample population was brown, with one person's eye colour being a combination of blue and green (Figure 4.3.8). 73.3 % of the sample population required some form of visual aid, such as glasses, to help them with their vision (Figure 4.3.9). Most of the students were unsure of their blood type. Out of the 12 that did know their blood type, 6 of them had the O blood type, 2 had B and 4 had A (Figure 4.3.10). Some of these results can be linked to one another in order to draw conclusions regarding the genetic makeup of a human being.

This data suggests that there is a link between height and sex. In terms of height, Figure 4.3.11. shows that the male population of the sample is generally taller than the female population. The height female population ranges between 150 cm to less than 180 cm, while the male population ranges between 160 cm to less than 200 cm. The height of both sexes is quite evenly distributed. The height of a human being is usually influenced by their genes. These genes are not generally sex linked, but it does appear that the sex of the human plays a role in the height of the human being. Therefore, sex could be linked to height.

When comparing weight to sex (Figure 4.3.12), there does not appear to be a direct link between the two. From the graph, it can be seen that the weight of the male population has a large range, while the female population have a shorter range. The weights of the male population are distributed unevenly, with most with most males weighing between 50 and less than 60 kilograms. Weight is also affected by the diet and lifestyle of a human being. From this data, weight cannot be linked to sex as there are very few patterns to suggest that this is the case.

When looking at the members of the sample population who have an Asian origin, certain similarities can be seen which are linked to genetics. Within the sample population, there are a total of 10 people with an Asian background. As Figure 4.3.12. shows, all people with Asian origins have dark coloured hair. Figure 4.3.13. also shows that this race also has dark coloured eyes. This data shows us that all people of an Asian background have both dark coloured hair and eyes, which means that this is a genetic mutation which has occurred in

order for the people of this area to adapt to the conditions of the region. The Asian countries are located close to the equator, where the Ultra Violet (UV) radiation is strongest. People in this region have evolved to have darker skin, hair and eyes in order to protect themselves from the harmful UV rays.

From the data collected, we can see a few examples of how race and gender can affect the phenotype of a human being. It can effect aspects such as height, weight, hair colour and eye colour. While things such as weight cannot be directly linked to sex, we can see links between height and sex as well as between hair and eye colour and racial background.

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Pictures

Cover Picture: Available From: https://cdn.goconqr.com/uploads/image_clipping/image/18579/diversity_genetic_variation.jpg [Accessed 6th November 2016]

Picture 1: Available From: http://sig5perspectives.pubs.asha.org/data/Journals/ASHASSOD/928707/37.jpeg [Accessed 6th November 2016]

Picture 2: Available From: http://services.dnadirect.com/img/content/common/cellsToDNA.gif [Accessed 6th November 2016]

Picture 3: Available From: http://image.slidesharecdn.com/random-121007045227-phpapp02/95/-19-728.jpg?cb=1349585690 [Accessed 6th November 2016]

Picture 4: Available From: http://images.slideplayer.com/24/7008929/slides/slide_17.jpg [Accessed 6th November 2016]

Picture 5: Available From: http://images.slideplayer.com/16/5215159/slides/slide_8.jpg [Accessed 6th November 2016]