College ABCD

Investigation Task

Assessment Period:	**2022 S2**
Course:	**MATHEMATICAL APPLICATIONS**
Unit:	**Unit 2: Mathematical Applications (1.0)**
Accreditation:	**T**
Weight:	**30%**
Maximum Mark:	**38**
Due Date:	**07 Oct**

Assessment Conditions

- Individual task
- Completed at home
- Scientific calculators, computer permitted

Additional Information

Students to submit their task electronically via the LMS

Students are expected to substantially complete and submit all assessment items. Exemption from an item and/or alternate assessment without penalty is available to students providing adequate documentary evidence to validate special circumstances. To meet the minimum assessment requirements of a unit, a student must substantially complete and submit at least 70% of the total assessment fulfilling all assessment conditions detailed on the task sheet.

Other Applicable Policies

Late penalties

Students are encouraged to submit work on time, as this is a valuable organisational skill and a key tenet of assessment condition standardisation. Students are expected to complete work, even if it is late, as soon as possible after the due date. The following policy is to ensure equity for all students:

- All assessment tasks are expected to be submitted by the specified due time and date. Unless otherwise stipulated, the due time is 4:00pm for the physical submission of assessment and 11:59pm for the digital submission of assessment, on the due date.
- Unless there are exceptional circumstances due to illness or misadventure, students must apply for an extension to the specified due date in advance, providing due cause and adequate documentary evidence for late submission to the respective Faculty Leader of Learning and/or Teaching and Learning Coordinator, after consulting their teacher. The Application for Extension of Assessment Submission Form is be submitted with the assessment item. The student must have the extension request form signed by at least one parent when the application for extension is submitted.
- A late penalty will apply unless an extension is granted. The penalty for late submission is 5% of possible marks per calendar day late, including weekends and public holidays, until a penalty of 35% or the notional zero is reached. If an item is more than 7 days late, it receives the notional zero score (Refer to 4.3.11 Notional Zeros). Submission on

weekends or public holidays may not be acceptable if a physical submission is required.

- It may not be possible to grade or score work submitted late after marked work in a unit has been returned to other students. Work not submitted by the time marked work is returned to other students may be declared as 'not submitted'. Students should be aware in writing if this will be less than 7 days after the due date and any extensions granted.

Academic Integrity

The BSSS and College ABCD is committed to a system of school-based assessment and views seriously any breach of the rules or instructions governing assessment. Any cheating, plagiarism, dishonesty, alteration of results or improper practice in relation to school-based assessment in any subject shall constitute a breach of discipline. This includes any tampering with the assessment data on computer files by a student.

Any work that is found to be in breach of discipline in in relation to school-based assessment will incur a penalty ranging from a reprimand and warning, in writing, through to the cancellation of all assessment results for Years 11 and 12. Students who unintentionally breach the rules of school-based assessment will be given appropriate counselling and guidance so they do not repeat the offence. The impact on unit scores of the penalties imposed for serious and repeated instances will be managed in accordance with the BSSS Policy and Procedures . Any offence will be reported to the Faculty Leader who will then inform the Teaching and Learning Coordinator for escalation to the Assistant Principal where necessary.

Students are to refer to and be familiar with the BSSS Academic Integrity: Student Guide to ensure student obligations and academic integrity are met. A College Referencing and Curriculum Guide is accessible via the student handbook.

The College uses Turnitin to assist students to prevent plagiarism and enhance academic skills for original thinking, authentic writing, proper attribution and academic integrity practices. Students are to use this tool to check text similarity, find missing citations and ensure proper citation using the Harvard Referencing Style for all assessment from first draft to final submission. The use of Turnitin does not apply to exams and in-class tests.

When submitting the task, students are to sign off on the below prompt made visible via the LMS:

I certify that:

(a) The work that I have submitted is my own work and has not been submitted for assessment before.

(b) I have kept a copy of this assignment and all relevant notes and references materials that I used in the production of the assignment.

(c) I have given references for all sources of information that are not my own, including the words, ideas and images of others.

For penalties for late and non-submission of work
Review BSSS Policy and Procedure Manual 4.3.10 for more details.

For academic integrity
Review BSSS Policy and Procedure Manual 4.3.12 for more details.

Part 1 Project Proposal:

The area I was assigned to research is 'Education in Males'. The data from the Gapminder website I have chosen to use is the 'Mean years in school (men 15 to 24 years)'. This data explains the average number of years of school attended by all males aged between 15 and 24 years for the year 2015 as this is the most recent year of data provided. The number of years of schooling includes years in primary, secondary and tertiary education. I believe the number of years of schooling is one of many important factors that could contribute to research and decision making for the topic 'Education in Males' as the number of years will have an impact on the quality of literacy and numeracy for education in males.

As a planet we have decided that education is important to our continued existence and mostly prioritise it highly. I would expect that most countries across the world will show at least 12 years of attendance at school for males aged between 15 and 24 in 2005.

I expect developed countries like Australia, the UK and US to have higher rates of years in schooling and I would also expect poorer or developing countries, like in Africa or parts of South America and Asia, to have lower number of years of schooling for males aged 15-24. Places that have experienced war or natural disasters in the years leading up to 2015 will probably have lower years of schooling for males. The events that come to mind here are war in Afghanistan, earthquakes in Haiti and the 2004 tsunami in the Indian Ocean that impacted many Asian counties.

I think it would be interesting to compare the result of the data analysis for males with females for the same age group and year to see the differences.

RC 2

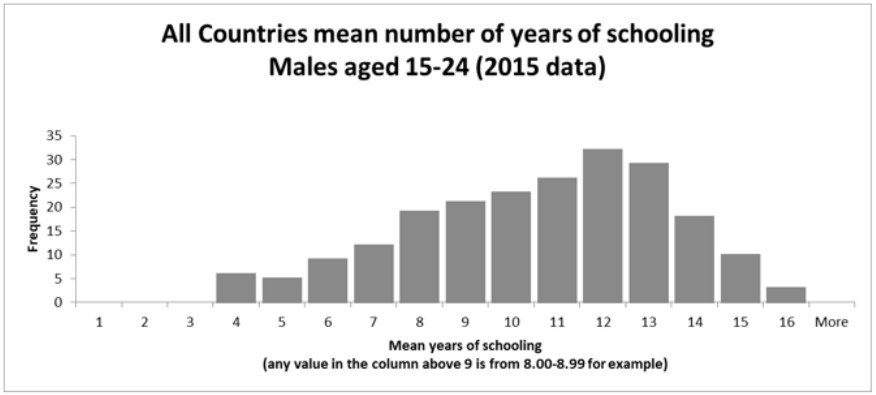
communicates **mathematical judgements and arguments in oral, written and/or multimodal forms, which are succinct and well-reasoned, using appropriate and accurate language**

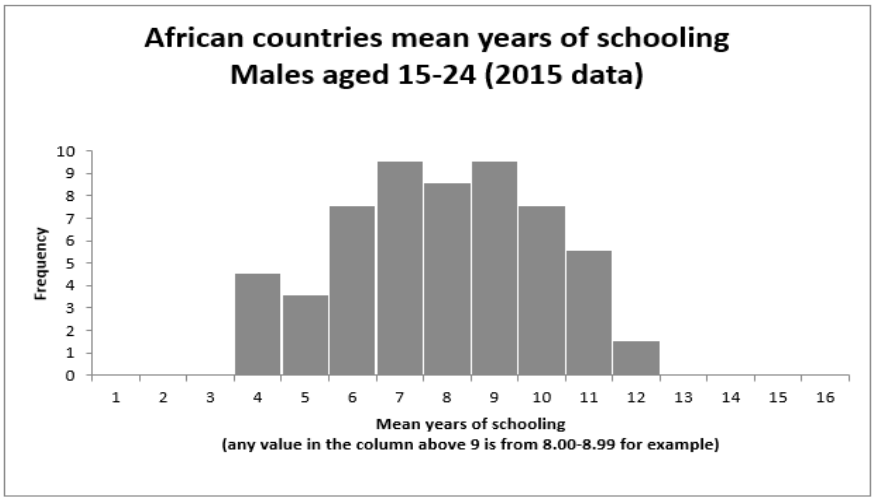
Student addresses rubric section 1 to an outstanding level explaining the link between the research topic and the data.

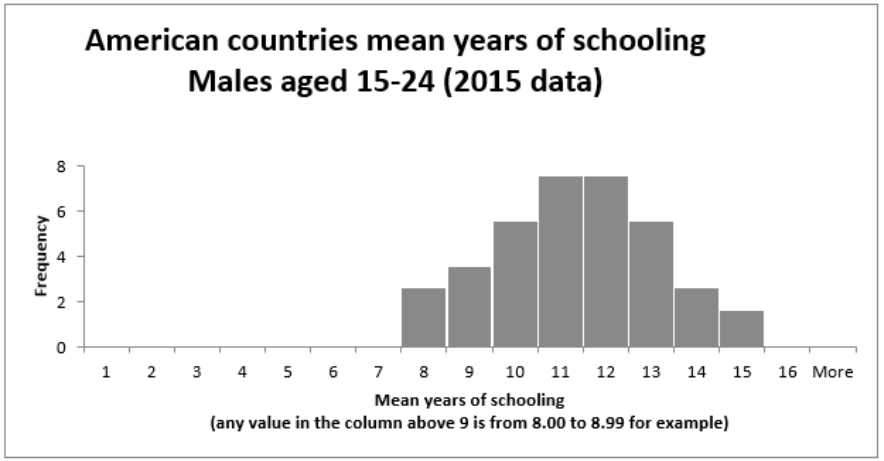
RC3

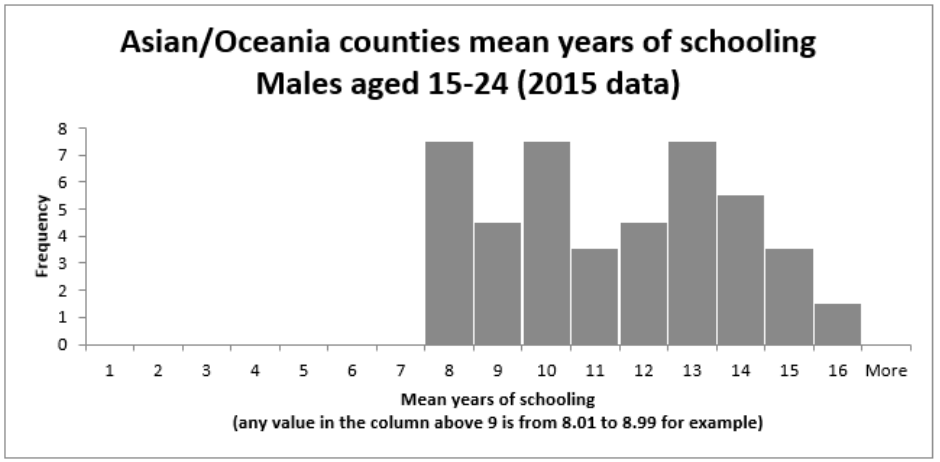
evaluates the reasonableness of solutions to routine and non-routine problems in a variety of contexts

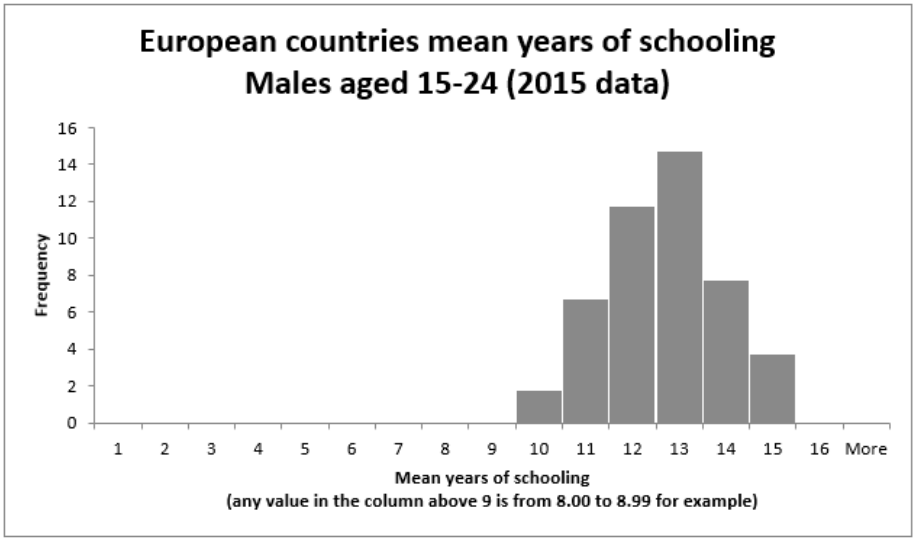
Student addresses rubric section 2 to an outstanding level demonstrating a reasonable outcome they expect and providing justification.

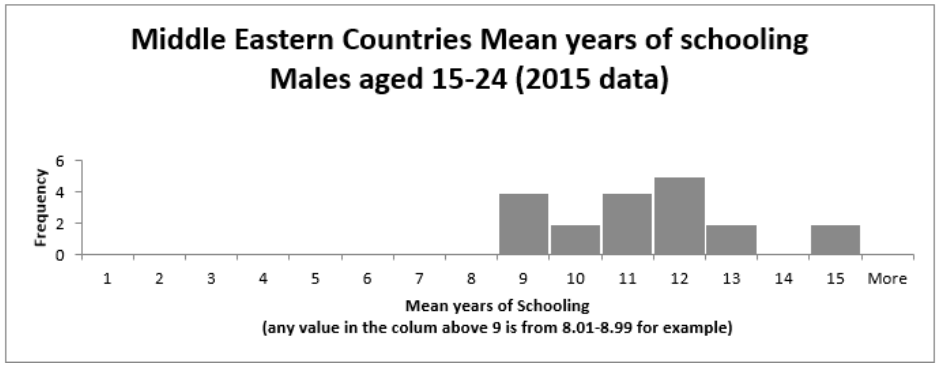












RC1

represents complex mathematical concepts in numerical, graphical and symbolic form in routine and non-routine problems in a variety of contexts

Student represents all sets of data as histograms with equal bucket sizes and same size x axis for ease of comparison and clear, detailed titles for the reader to have accurate context.

RC2

communicates mathematical judgements and arguments in oral, written and/or multimodal forms, which are succinct and well-reasoned, using appropriate and accurate language

Student has used multiple statistical measures to summarise their data analysis making reference to both the histograms and boxplots throughout the various summaries. Student has used statistical language and accurate descriptions of the data sets.

All Data:

188 countries had reported about the average (mean) years of schooling for males in their population who were aged 15-24 years old. This data shows a negative skew with the modal group being between 11.00 and 11.99 years of schooling.

The standard deviation of 2.63 tells us that 68% of the 15–24-year-old males from the 188 countries surveyed have between 7.54 and 12.81 years of schooling.

There are no mathematical outliers using the 1.5*IQR rule for this data.

African Data:

In 2015, 56 African countries reported data on the number of years of schooling their males aged 15-24 had achieved. The mean of 7.6 years is the lowest of any region by a significant amount as all other regions have means of 10.75 years or higher.

The standard deviation of 2.2 years is the second largest standard deviation of any other region indicating that these scores are widely spread out and that 68% of the surveyed respondents replied that they had on average 5.39-9.46 years of schooling.

The data is bimodal with the most common response being 6.00-6.99 years of schooling or 8.00-8.99 years of schooling. The data is somewhat symmetrical looking at the centre of the data and although there is not an outlier using the 1.5*IQR rule.

The range of responses for the African data is the largest of any region and this is seen in the boxplot on page 7 where the difference between the minimum and maximum years of schooling can be seen to be 10.1 years—this is quite a significant difference and represents Niger on the low end with 3.6 years of schooling on average and Tunisia on the high end with an average 11.3 years of schooling, this prompted me to look at a map of Africa and realise just now close these two countries are with only Algeria in between them to the east or Libya to the west.

American Data:

In 2015, 33 countries in North, Central and South America replied to the survey regarding the number of years of schooling their males aged 15-24 had achieved. The data is quite symmetrical (not perfectly) with a mean and median of 10.8 years.

The standard deviation of 1.71 tells us that 68% of the respondents had between 9.12 and 12.54 years of schooling. This result in quite like the Middle Eastern and Asian/Oceanian results.

This data is bimodal with most responses representing from 10.00 to 11.99 years.

Asian/Oceania Data:

In the Asia/Oceania region, 42 countries responded to the survey on the mean years of schooling for males 15-24 years old in the year 2015.

The standard deviation of 2.44 is the largest of any region and tells us that data is most spread out. The boxplot as drawn on page 7 shows that the data for this region is the most spread out and reinforces the large standard deviation value.

Looking at the histogram, we see no discernible pattern to the data. Even when I separated the data into Asia and then Oceania and looked at the graphs separately, there still appeared to be no real pattern. However, the mean is quite like most other regions (except Africa).

The IQR tells is that 50% of the male respondents aged 15-24 years had between 8.65 and 12.9 years of schooling. Again, there were no outliers for this data.

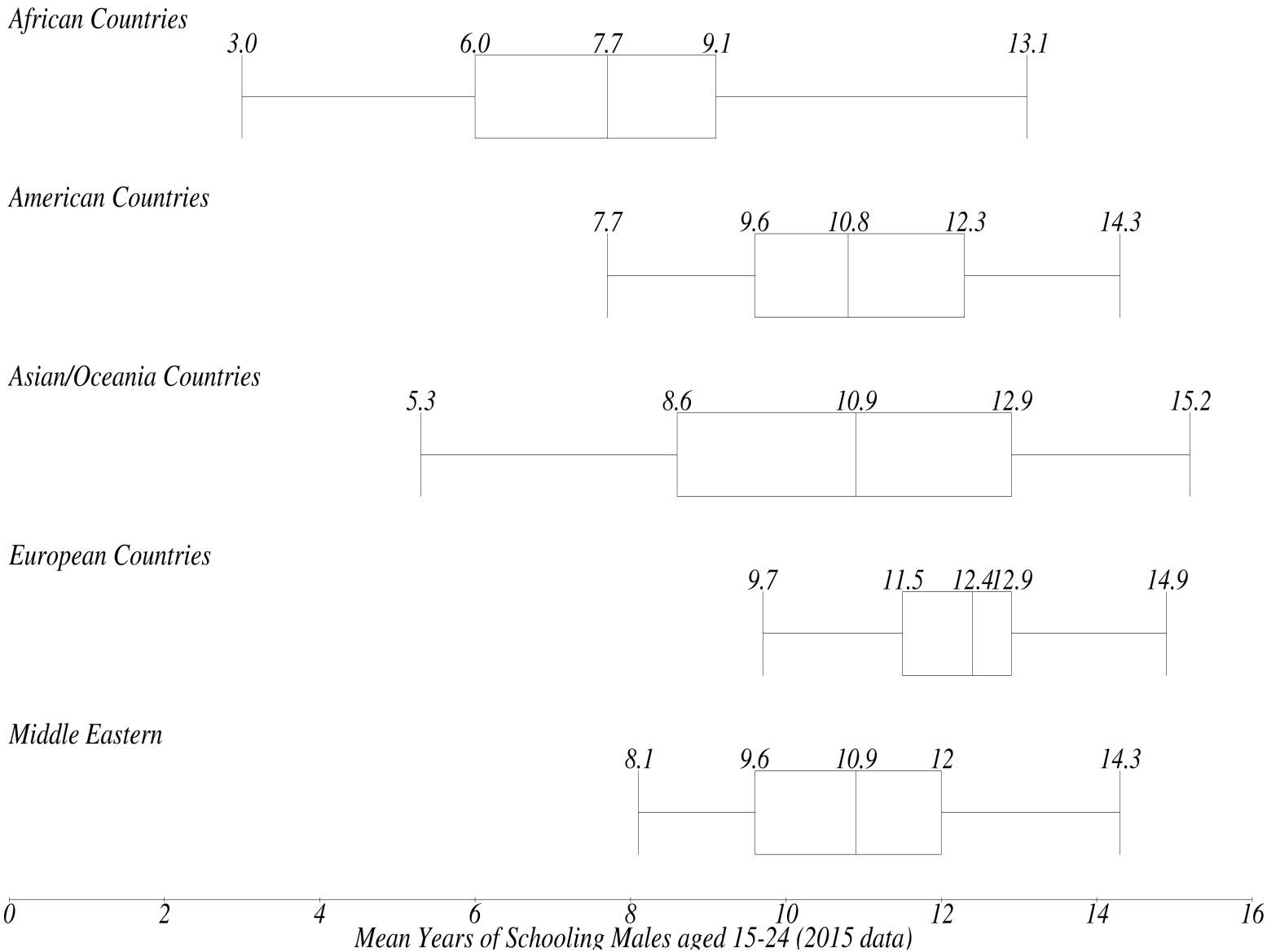
European Data:

In 2015, 43 European countries replied to the survey about males aged 15-24 years of age and their mean number of years of schooling. The data appears to be slightly positively skewed. The mean of 12.25 years is quite close to the median of 12.4 years. This data is not very spread out and had the lowest standard deviation (1.13) and IQR (1.4) of any of the other regions indicating the number of years of schooling for males is quite consistent and there are no outliers for this data set. The boxplot figure on page 7 is a visual reinforcement of the European countries having the most consistent data of any other region.

Middle Eastern Data:

In 2015, 14 countries in the Middle East replied to the survey asking about the average year of schooling for males aged 15-24. This data shows no discernible pattern to the responses. Graphically is appears as though there might be an outlier for Israel with 14.3 years of schooling when compared to the other countries in this region but using the 1.5*IQR rule does not justify this. The standard deviation (1.63) and IQR (2.43) values are the second lowest for any region investigated in this survey telling us the results are quite consistent.

The mean and median are the exact same value at 10.85 but the modal group is 11.00-11.99 years of schooling. Usually when the median and the mean are the same, we would expect a normal distribution, that is not the case in this data set.



RC1

represents complex mathematical concepts in numerical, graphical, and symbolic form in routine and non-routine problems in a variety of contexts

Student represents all sets of data as boxplots with same scale for ease of comparison and clear, detailed titles for the reader to have accurate context.

Part 3 Conclusions and recommendations:

My data analysis did alight with my proposal in that I expected African countries to have the lowest measures of central tendency and European countries to have the highest measures of central tendency. However, I was surprised that African countries had such a wide spread of results and that European countries had such a small spread of results. I was also surprised that the median for the American, Asian/Oceania and Middle Eastern countries was so similar and that the boxplots representing the American countries and Middle Eastern countries looked so similar.

This analysis can be used by Australian Aid to make decision about how to spend their $10 000 000 for Education for Males. I would encourage most of the money be spent in Africa which shows the lowest number of years of schooling for males. There are 24 countries in Africa with average number of years of schooling for males at less than 7 years. I would use this as a threshold for other regions like Asia where Afghanistan also has an average number of years of schooling at 5.27 for males aged 15-24. This is a total of 25 countries. The method I used for determining how the $10 000 000 could be spent fairly is to determine how many "years" were needed for each country to reach 7 years of schooling, using excel in column C I typed=7-b2 for example. I then totalled that column to determine there was 36.46 years needed. I then worked out which percentage of the 36 years was needed by each country for example South Sudan needed 7-3.02 = 3.98 years and 3.98/36.46*100 is 10.92% lastly, I determined which is the value of 10.92% of $10 000 000.00 which is $1 091 607.24.

This would mean that Africa should receive 95.26% of the funding Australian Aid has to give for Male Education. Asia (Afghanistan) should receive 4.74% of the funding.

(See table below for breakdown by country—also available on the Spreadsheet on Sheet named Proportional Spread of Aid)

RC 5/RC 2/CT 3
evaluates the potential of Mathematics to generate knowledge in the public good
communicates mathematical judgements and arguments in oral, written and/or multimodal forms, which are succinct and well-reasoned, using appropriate and accurate language
constructs, selects and applies complex mathematical models to routine and non-routine
Student creates and uses an excellent mathematical model to communicate how they would use the Aid money to equitably to impact the public good in a fair manner.

Country	Average number of years of schooling	Number of Years less than 7 years of schooling	Percentage of the total	Amount of Aid each country should receive
South Sudan	3.02	3.98	10.92%	$ 1,091,607.24
Niger	3.6	3.4	9.33%	$ 932,528.80
Burkina Faso	3.76	3.24	8.89%	$ 888,645.09
Mali	3.76	3.24	8.89%	$ 888,645.09
Somalia	4.03	2.97	8.15%	$ 814,591.33
Mozambique	4.79	2.21	6.06%	$ 606,143.72
Guinea-Bissau	4.96	2.04	5.60%	$ 559,517.28
Chad	5.08	1.92	5.27%	$ 526,604.50
Senegal	5.26	1.74	4.77%	$ 477,235.33
Afghanistan	5.27	1.73	4.74%	$ 474,492.59
Burundi	5.56	1.44	3.95%	$ 394,953.37
Guinea	5.7	1.3	3.57%	$ 356,555.13
Rwanda	5.82	1.18	3.24%	$ 323,642.35
Madagascar	5.88	1.12	3.07%	$ 307,185.96
Sierra Leone	5.97	1.03	2.83%	$ 282,501.37
Angola	6.14	0.86	2.36%	$ 235,874.93
Mauritania	6.36	0.64	1.76%	$ 175,534.83
Liberia	6.46	0.54	1.48%	$ 148,107.52
Ethiopia	6.54	0.46	1.26%	$ 126,165.66
Benin	6.55	0.45	1.23%	$ 123,422.93
Cote d'Ivoire	6.59	0.41	1.12%	$ 112,452.00
Central African Republic	6.79	0.21	0.58%	$ 57,597.37
Malawi	6.85	0.15	0.41%	$ 41,140.98
Gambia	6.87	0.13	0.36%	$ 35,655.51
Eritrea	6.93	0.07	0.19%	$ 19,199.12
Total		36.46	100.00%	$10,000,000.00

Reflection

Soon after receiving this assignment, I downloaded my data and determined which region each country belonged to. While doing so I was looking at the numbers and was quite surprised by how low some of them were. I completed the spreadsheet component quite early on and the box plots. I put all this data together in this document so that I could see the information. I then made another sheet in my spreadsheet where I copied and pasted all of the analysis onto 1 sheet so that I did not need to keep swapping back and forth.

I then used my class notes/textbook, the spreadsheet, the graphs and the example assignment to write a summary of what each region's data represented. I believe I used my time and resources well. I finished my assignment about 3 days before the due date and then the day before read through it all again as well as the assignment sheet and rubric to ensure I addressed each area needed. The only area where I felt a little uncertain was describing some of the histograms that did not really fit the definitions we looked at in class.

RC4
reflects on their own thinking and analyses planning, time management, use of appropriate strategies to work independently and collaboratively
Student reflects on their own thinking and analyses their time management effectiveness. More detail on their thinking process would have made this a stronger response.

A grade student response Rubric

Project proposal	A grade response	B grade response	C grade response	D grade response	E grade response
Area of study and data used to measure from Gapminder website. **(5 marks)**	Clearly stated Area of Research and data you are using to measure this with a well reasoned and succinct justification for why this measure will be appropriate for the area of research.	Area of research and data measurement stated. Clearly stated link between area of research and data used to measure with the use of clear, reasoned appropriate and accurate language.	Area of research and data measurement stated. Link between measurement data and area of research made using appropriate and accurate language.	Area of research and data measurement stated. Link between measurement data and area of research discussed with some appropriate language used.	Area of research and data measurement stated, no explanation of how this data can be used to measure the area of research.
Expectation **(5 marks)**	Clearly stated, well reasoned and succinct justification for what you expect the results to show for ALL data and REGIONAL data with succinct, well-reasoned explanation for your reasoning	Justification for what you expect the results to show for ALL data and REGIONAL data using clear, reasoned, appropriate and accurate language.	Justification for what you expect the results to show for ALL data and REGIONAL data using appropriate and accurate language.	Expectation for ALL data and REGIONAL data provided with some justification using some appropriate language.	Expectation for ALL data and REGIONAL data provided without justification.

Data Analysis and Display	A grade response	B grade response	C grade response	D grade response	E grade response
Data Analysis for data by REGION and for ALL data **(25 marks)**	Selected and applied an appropriately efficient spreadsheet formula to find mean, standard deviation, 5 number summary values, IQR, range, outliers and clearly	Selected and applied an appropriately efficient spreadsheet formula to find mean, standard deviation, 5 number summary values, IQR, range, outliers. All	Applied spreadsheet formula to find mean, standard deviation, 5 number summary values, IQR, range, outliers. All formulas are able to be	Applied spreadsheet formula to find some of the measures of data analysis: mean, standard deviation, 5 number summary values, IQR,	Applied spreadsheet formula to find some of the measures of data analysis: mean, standard deviation, 5 number summary values, IQR,

	labelled analysis measures and formulas are able to be read.	formulas are able to be read.	read	range, outliers. All formulas are able to be read.	range, outliers.
Data Display- **Histograms** **(15 marks)**	Represented mathematical concepts in graphical form with clear titles and consistent group sizes for all 5 groups of REGIONAL data	Represented mathematical concepts in graphical form with consistent group sizes and titles for all 5 groups of REGIONAL data.	Represented mathematical concepts in graphical form and informative titles for all 5 groups of data.	Represented mathematical concepts in graphical form with titles for all 5 groups of data.	Represented mathematical concepts in graphical form for some of the REGIONAL data.
Data Display- **Boxplot** **(15 marks)**	Represented mathematical concepts in graphical form with clear titles and a shared scale for all 5 groups of REGIONAL data.	Represented mathematical concepts in graphical form with titles and a shared scale for all 5 groups of REGIONAL data.	Represented mathematical concepts in graphical form with informative titles for all 5 groups of REGIONAL data.	Represented mathematical concepts in graphical form with titles for all 5 groups of REGIONAL data.	Represented mathematical concepts in graphical form for some of the regional data.
Report **(15 marks)**	Communicates mathematical judgements and arguments in written form which is succinct and well-reasoned, using appropriate and accurate language and references to multiple statistical measurements as evidence.	Communicates mathematical judgements and arguments in written form which is reasoned, using appropriate language and references to multiple statistical measurements as evidence.	Communicates mathematical judgements and arguments in written form using some appropriate language and references to some statistical measurements as evidence.	Communicates simple mathematical judgements in written form referencing some statistical measurements as evidence.	Communicates simple mathematical judgements in written form with limited use of appropriate language.

Conclusions and recommendations	**A grade response**	**B grade response**	**C grade response**	**D grade response**	**E grade response**

Use of data analysis **(15 marks)**	Succinctly used various mathematical calculations to communicate and evaluate the potential of Mathematics to make decisions for the public good.	Used various mathematical calculations to communicate and analyse the potential of Mathematics to make decisions for the public good.	Used some mathematical calculations to communicate and explain the potential of Mathematics to make decisions for the public good.	Used some mathematical calculations to communicate and describe the potential of Mathematics to make decisions for the public good.	Identified some ways in which Mathematics is used to generate knowledge for the public good.
Reflection **(5 marks)**	Reflected with insight on their own thinking and evaluated planning, time management and use of appropriate strategies to work independently.	Reflected on their own thinking and analysed planning, time management and use of appropriate strategies to work independently.	Reflected on their own thinking and explained planning, time management and use of appropriate strategies to work independently.	Reflected on their own thinking with some reference to planning, time management and use of appropriate strategies to work independently.	Reflected on their own thinking with little or no reference to planning, time management and use of appropriate strategies to work independently.
Teacher Feedback	Great work on this assessment. Your work on the recommendation of how Australian Aid would spend its $10 000 000 on Education in Males was particularly well explained and thought out. Your analysis and report throughout was done well and demonstrated well-reasoned explanations and multiple references to statistical measures used in your spreadsheet. Your spreadsheet showed very clear organisation and great use of efficient spreadsheet formulas. I would suggest some deeper thought and evaluation of your time and resources in future submissions.				