Helping students interpret large-scale data tables

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Introduction

New technologies have completely altered the ways that citizens can access data. Indeed, emerging online data sources give citizens access to an enormous amount of numerical information that provides new sorts of evidence used to influence public opinion. In this new environment, two trends have had a significant impact on our increasingly data-driven society: 1) the increasing use of large-scale databases within the open data movement, and 2) the growing use of big data.

The open data movement supports the availability of high quality data sets collected by national statistics offices and non-government organisations for a specific purpose. These data are characterised by several features: the data are multivariate, consist of clearly defined measures, the population is known, and the data generation and presentation have been subjected to extensive scrutiny. These data are made available to all citizens. The open data movement has had significant success in recent years in persuading major data providers, and national statistics offices, (for example, the Australian Bureau of Statistics [ABS]) to give citizens access to huge databases in order to create new variables, and explore new relationships.

Big data, in contrast to open data, is not generated by national statistics offices, and therefore is not publicly available. It is only available through proprietary sources, and is owned by companies that gain financial advantage from using it.

These two trends offer considerable promise in enhancing people's understanding of complex scientific and societal issues, such as political and organisational change, population growth, and immigration.

This new access to data is having a profound impact on teaching statistics and modernising curricula to prepare students for a world filled with open and big data, or the so-called "data deluge". The comprehension and interpretation of large data tables are important skills to possess.

This article focuses on a specific technique for teaching students to read data tables. Using a general framework suggested by Australian researchers, the article looks at a specific implementation of the framework in teaching specific tables.

Theoretical framework

The expanding use of large-scale data for prediction and decision-making in almost all domains of life makes it a priority for mathematics school curricula worldwide to help students develop their understanding of key statistical ideas prior to entering college. This includes understanding of data presented in tabular form, which is a core aspect of statistics, essential to conducting meaningful data analysis.

Data-tables are used broadly in the media to present, disseminate, and explain information, thus students need to be able to read and interpret them in meaningful ways. Koschat (2005)

identifies three main advantages when using tables for providing information. Firstly, a table represents data, or a summary of data, in numerical form. Secondly, people can easily use the data and convert it to other forms such as a graph or a model if they wish to do so, but it is not easy in reverse. Thirdly, it can quite often be the case that the reader wants to interpret the actual numbers. For the reasons described by Koschat (2005), tables are important, and therefore it is important for teachers to help their students develop the ability to read tables effectively. It is expected that teachers would provide learning experiences and discussion regarding ways in which data may be collected and summarised in the table, therefore helping students with developing awareness of the potential pitfalls and distortions of data collection. Teachers can bring an awareness of the process of data collection to their interpretations of data.

A number of research studies about the difficulties that learners experience showed that students have particular difficulty in drawing inferences from tables and graphs, in interpreting the data, and making predictions from tables and graphs (For example, Estrepa, Batanero, and Sanchez, 1999; Friel, Curcio, and Bright, 2001; Pereira-Mendoza and Mellor, 1991; Sharma, 1997; 2013), but beyond these studies, there appears to be little research on learners' comprehension of tables, despite the pervasive use of data-tables in statistical data analysis and textbooks of statistics. The limited existing literature in statistics education addresses table learning in children (Brizuela and Alvarado, 2010; Brizuela and Lara-Roth, 2002; Gabucio et al., 2010; Martí, 2009; Martí et al., 2010). Brizuela and Lara-Roth (2002) showed that 7-year-old students, who had not received direct instruction in the use and configuration of tables, could use information from a table to work on a problem. Estrella and Mena (2014) investigated primary-school children's comprehension of statistical frequency tables, while the students produced the tables as part of their response to a data analysis situation. They identified different types of data structure of tables in these students, such as text lists without counting, text lists with counting, tables with icons with and without counting, tables with text with and without counting, and tables with text without individual counts but with marginal totals. These primary students' conceptualisation of tables allowed Estrella and Mena (2014) to explore how students register data in a table, count in a table, list elements belonging to a class, and use partitioning, equivalence relations, and counting that allow for ordering data to obtain information in order to place data in rows, columns and cells, and to use written language to label headings.

There is a need for considerable research still to be done since such work does not answer the many questions about how students reason about tables. However, even without better theoretical descriptions, there are already suggestions for pedagogical tools that can aid students in developing ideas that support their understanding of tables. This paper discusses the potential implementation of one such framework for helping students learn to read and interpret tables.

One method of teaching interpretation of tables

The Australian researchers, Kemp and Kissane (2010, 2005) described a five-step framework for critically interpreting quantitative data in the form of tables or graphs. This article will use this framework as the foundation for the discussion and development of specific questions that could be used in teaching how to read and interpret tables.

The five-step framework summarised in Table 1 (Kemp and Kissane, 2010), was intended to provide a framework within which teaching can be planned to support students' development of their levels of thinking from simple point extraction through to making comparisons of data, interpolating and finding relationships in the data and looking for trends and meanings. The five-step framework offers a generic template for teachers to help their students develop strategies for interpreting data in tabular form. This article will focus on how the Kemp and Kissane framework can be used to develop specific questions for specific tables, as examples for how the framework can be implemented in teaching practice (For a discussion of the development and validation of the five-step framework, see Kemp, 2005).

Table 1. Five-step framework for Interpreting Tables and Graphs (Kemp and Kissane, 2010, p. 3).

Step 1: Getting started
Look at the title, axes, headings, legends, footnotes and source to find out the context and expected quality of the data. Take into account information on the question asked in surveys and polls, sample size, sampling procedures and sampling error.
Step 2: WHAT do the numbers mean?
Make sure you know what all the numbers (percentages, '000s, etc.) represent. Look for the largest and smallest values in one or more categories or years to get an impression of the data.
Step 3: HOW do they differ?
Look at the differences in the values of the data in a single data set, a row or column or part of a graph. This may involve changes over time, or comparison within a category, such as male and female at any time.
Step 4: WHERE are the differences?
What are the relationships in the table that connect the variables? Use information from Step 3 to help you make comparisons across two or more categories or time frames.
Step 5: WHY do they change?
Why are there differences? Look for reasons for the relationships in the data that you have found by considering social, environmental and economic factors. Think about sudden or unexpected changes in terms of state, national and international policies.

This framework for interpreting tables and graphs in their contexts provides a progression from simple numerical reading of a table to more complex interpretations of tables and graphs required for a better understanding of data in their context. The authors claimed that the level of complexity of the table could vary according to the type of materials being studied as well as the statistical concepts being covered at the time.

In this paper, I suggest that a preliminary step, Step 0, be added to the framework:

> **Step 0: Why was the data collected?**
> Reason why the data were collected, trying to find out the purpose of the data collection. Think about the assumption made in naming the categories used to describe the data in the table (or graph), and explain the implications on looking for associations within the data (Step 4) where renaming the categories. Ask whether you can categorise the data in other ways that are more meaningful.

In the rest of this article, this framework will be used to help develop questions that could be used to teach students how to read and interpret data tables better.

Table 2 was taken from the economic datasets designed to increase students' understanding of data and statistics provided by the Australian Bureau of Statistics, while giving insights into the lives of Australians. It displays data of the labour force status from Jan 2009 to January 2014 (monthly). These data are a part of a larger table that concerns the "Labour Force Status, Jan 2009 to Jan 2014 (monthly)" and have been extracted from a wide range of ABS publications. There are many statistics releases available on the ABS website (http://www.abs.gov.au/browse?opendocument&ref=topBar) that teachers can use to supplement their teaching materials.

Table 2 shows data on changes in the Labour force status that can be used to reflect on the economy of Australia or the population of Australia. This table was selected to illustrate the kind of questions that could be asked about the ways in which data were collected and why categories are devised.

Table 3 illustrates examples of the kind of questions based on the six-step framework that may be asked to help students to develop strategies in table reading and interpreting of data.

Table 2. Data set Eco3: Labour Force status, Jan 2009 to Jan 2014 (monthly)

Period	Employed full-time ('000)	Employed part-time ('000)	Employed total ('000)	Unemployed – looking for full-time work ('000)	Unemployed – looking for part-time work ('000)	Unemployed total ('000)	Labour Force ('000)	Unemploy-ment Rate (%)	Participation Rate (%)
Jan-2009	7,687.2	3,103.6	10,790.8	399.2	164.4	563.6	11,354.4	5.0	65.5
Feb-2009	7,676.4	3,114.2	10,790.6	426.1	169.2	595.3	11,385.9	5.2	65.6
Mar-2009	7,663.7	3,125.5	10,789.2	451.1	172.1	623.1	11,412.3	5.5	65.6
Apr-2009	7,648.0	3,138.3	10,786.3	471.2	172.9	644.2	11,430.4	5.6	65.6
May-2009	7,630.1	3,153.2	10,783.2	484.9	171.5	656.4	11,439.7	5.7	65.6
Jun-2009	7,612.4	3,169.4	10,781.8	491.9	169.0	660.9	11,442.7	5.8	65.5
Jul-2009	7,598.1	3,186.1	10,784.3	493.6	166.7	660.4	11,444.6	5.8	65.4
Aug-2009	7,590.3	3,202.6	10,792.9	491.4	165.7	657.1	11,450.0	5.7	65.3
Sep-2009	7,589.0	3,219.6	10,808.6	485.9	165.6	651.5	11,460.1	5.7	65.3
Oct-2009	7,594.6	3,235.8	10,830.4	477.3	166.1	643.4	11,473.8	5.6	65.3
Nov-2009	7,604.9	3,251.3	10,856.2	468.1	166.8	634.9	11,491.1	5.5	65.3
Dec-2009	7,616.8	3,264.6	10,881.4	460.4	167.9	628.3	11,509.7	5.5	65.3
Jan-2010	7,630.3	3,272.8	10,903.2	453.9	169.1	623.1	11,526.2	5.4	65.3
Feb-2010	7,644.8	3,275.9	10,920.7	449.2	170.3	619.5	11,540.1	5.4	65.3
Mar-2010	7,660.1	3,274.8	10,934.9	446.3	170.9	617.2	11,552.1	5.3	65.2
Apr-2010	7,678.5	3,271.3	10,949.8	443.4	171.1	614.6	11,564.4	5.3	65.2
May-2010	7,699.6	3,268.3	10,967.9	439.2	171.7	610.9	11,578.8	5.3	65.2
Jun-2010	7,723.1	3,268.3	10,991.5	433.7	173.6	607.2	11,598.7	5.2	65.3
Jul-2010	7,749.8	3,272.2	11,021.9	427.5	176.3	603.7	11,625.7	5.2	65.3
Aug-2010	7,776.1	3,279.6	11,055.7	422.0	178.8	600.8	11,656.5	5.2	65.4
Sep-2010	7,798.8	3,288.4	11,087.2	418.4	180.6	599.0	11,686.3	5.1	65.5
Oct-2010	7,819.2	3,295.4	11,114.6	416.2	181.1	597.3	11,711.9	5.1	65.6
Nov-2010	7,839.2	3,298.7	11,137.9	414.5	179.9	594.4	11,732.4	5.1	65.6
Dec-2010	7,856.9	3,299.8	11,156.8	412.9	177.7	590.6	11,747.3	5.0	65.6
Jan-2011	7,871.8	3,299.6	11,171.4	411.4	175.1	586.6	11,757.9	5.0	65.6
Feb-2011	7,883.9	3,297.9	11,181.8	410.2	172.8	583.0	11,764.7	5.0	65.5
Mar-2011	7,893.2	3,296.1	11,189.3	409.7	171.2	580.9	11,770.2	4.9	65.5
Apr-2011	7,897.9	3,297.4	11,195.3	411.6	171.0	582.7	11,778.0	4.9	65.4
May-2011	7,899.3	3,302.2	11,201.5	416.1	171.6	587.7	11,789.2	5.0	65.4
Jun-2011	7,899.0	3,310.1	11,209.0	422.4	172.5	594.9	11,803.9	5.0	65.4
Jul-2011	7,897.7	3,319.3	11,217.1	429.6	173.7	603.3	11,820.4	5.1	65.4
Aug-2011	7,898.6	3,327.4	11,226.0	436.1	175.0	611.1	11,837.1	5.2	65.4
Sep-2011	7,903.1	3,331.9	11,235.0	440.3	175.6	615.9	11,850.9	5.2	65.4
Oct-2011	7,909.6	3,333.1	11,242.7	442.3	175.4	617.7	11,860.4	5.2	65.4
Nov-2011	7,917.3	3,332.6	11,249.9	442.2	174.7	616.8	11,866.7	5.2	65.3
Dec-2011	7,928.5	3,332.1	11,260.6	440.2	174.2	614.4	11,875.0	5.2	65.3
Jan-2012	7,942.6	3,333.9	11,276.5	436.9	174.9	611.8	11,888.3	5.1	65.2
Feb-2012	7,956.1	3,339.8	11,295.8	433.5	177.3	610.8	11,906.7	5.1	65.2
Mar-2012	7,966.8	3,349.0	11,315.8	430.7	179.8	610.5	11,926.4	5.1	65.2
Apr-2012	7,973.8	3,359.4	11,333.1	430.2	181.0	611.2	11,944.4	5.1	65.2
May-2012	7,978.3	3,367.1	11,345.4	433.7	180.3	614.0	11,959.4	5.1	65.2
Jun-2012	7,983.1	3,369.4	11,352.5	440.6	178.3	618.9	11,971.4	5.2	65.2
Jul-2012	7,990.4	3,365.6	11,356.0	449.6	175.2	624.9	11,980.9	5.2	65.1
Aug-2012	8,000.4	3,359.3	11,359.7	458.6	172.6	631.2	11,990.9	5.3	65.1
Sep-2012	8,012.1	3,355.5	11,367.6	464.8	171.9	636.7	12,004.3	5.3	65.1
Oct-2012	8,022.3	3,359.0	11,381.2	467.1	173.7	640.8	12,022.1	5.3	65.1
Nov-2012	8,028.8	3,370.3	11,399.0	467.2	177.6	644.8	12,043.8	5.4	65.1
Dec-2012	8,031.5	3,387.4	11,418.9	467.8	181.8	649.6	12,068.5	5.4	65.1
Jan-2013	8,030.3	3,407.3	11,437.6	471.0	184.3	655.4	12,093.0	5.4	65.2
Feb-2013	8,028.0	3,425.6	11,453.7	478.1	184.2	662.3	12,116.0	5.5	65.2
Mar-2013	8,026.2	3,439.0	11,465.2	487.6	182.9	670.5	12,135.7	5.5	65.2
Apr-2013	8,025.9	3,445.9	11,471.8	497.1	181.7	678.8	12,150.6	5.6	65.2
May-2013	8,025.3	3,448.4	11,473.7	504.4	181.0	685.4	12,159.1	5.6	65.1
Jun-2013	8,023.6	3,450.1	11,473.6	509.0	181.2	690.2	12,163.9	5.7	65.0
Jul-2013	8,019.9	3,453.8	11,473.7	510.7	183.0	693.6	12,167.3	5.7	65.0
Aug-2013	8,012.9	3,460.9	11,473.8	511.0	185.3	696.2	12,170.0	5.7	64.9
Sep-2013	8,002.7	3,470.1	11,472.8	512.3	186.9	699.2	12,172.0	5.7	64.8
Oct-2013	7,991.4	3,480.2	11,471.6	515.6	187.4	703.0	12,174.6	5.8	64.7
Nov-2013	7,979.8	3,490.4	11,470.3	520.7	187.0	707.6	12,177.9	5.8	64.6
Dec-2013	7,968.9	3,499.6	11,468.4	526.4	186.1	712.5	12,181.0	5.8	64.6
Jan-2014	7,959.2	3,507.6	11,466.9	532.8	185.0	717.7	12,184.6	5.9	64.5

Source: http://www.abs.gov.au/websitedbs/CaSHome.nsf/Home/Economy+Datasets

Table 3. Using the six-step framework for Interpreting Labour Force Status, January 2007 to January 2014 (Monthly)

Step 0: Why was the data collected?
Q: Why was the data collected? **Q**: If we rename the categories used to describe the data in table would this alter the later process of looking for associations within the data? **Q**: Can the data be categorised in other ways that are more meaningful?
Step 1a: Getting started
Q: When looking at the title, what is the general topic being examined? **Q**: When looking at the column labels of the variables of labour force status, what is being compared? **Q**: Examine the row labels. What period of time is represented in each row?
Step 1b: Data quality
Q: What is the source of the data? **Q**: What is the credibility of the data? **Q**: What is the release date of the data?
Step 2: WHAT do the numbers mean?
Q: In the table header, there are descriptions of each column of numbers. Consider the first numerical column: what is the meaning of 7,956.1? **Q**: How many workers are employed full time? How many workers are unemployed looking for part-time work? **Q**: What is the meaning of the 5.1 in the eighth numerical column? How was it calculated? **Q**: What is the meaning of 65.5 in the last column for February 2012? How was it calculated? **Q**: Why don't the three percentages for unemployment and participation rate add up to 100?
Step 3: HOW do they differ?
Q: List in descending order the five months that show the highest unemployment rate (include the percentages). **Q**: Which months/years have the highest unemployment rate? And the lowest unemployment rate? **Q**: For how many months is the number of unemployed looking for full-time work higher than the number of unemployed looking for part-time work? **Q**: Which year shows the greatest difference between the total number of people reported as employed and the total number of people reported as unemployed? **Q**: Which year has the greatest range of variation between the highest monthly employment rate and the lowest monthly employment rate?
Step 4: WHERE are the differences?
Consider the employed workers: **Q**: For employed workers the number of employed full-time workers is more than the number of employed part-time workers in most months. Compare the number of employed full-time workers to the number of employed part-time workers during different months/years. What do you notice?
Step 5: WHY do they differ?
Q: When data are collected and collated into groups someone makes decisions about those groups. Consider the grouping of the labour force. Consider some other grouping that would make sense to you. **Q**: Look at how the unemployment rate changes from month to month. What do you notice? **Q**: Suggest reasons for the differences in the number of workers who are unemployed looking for full-time jobs, and the number of unemployed looking for part-time jobs.

The second example of how the six-step framework can be developed into specific teaching questions comprises Table 4, which has an example of data to be examined and Table 5, which includes questions for students based on application of the Kemp framework to the specific example.

Table 4. Annual Gross Domestic Product (GDP), Measures over time, 2002–03 to 2012-13 (financial yearly).

Chain volume GDP and related measures (b)	2002 -03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
GDP	3.2	4.1	3.2	3.0	3.8	3.8	1.6	2.1	2.4	3.4	2.8
GDP per capita (c)	1.9	2.9	2.0	1.6	2.1	1.9	-0.5	0.2	1.1	1.8	1.1
GDP market sector (d)	3.2	4.7	3.3	3.2	4.1	4.3	1.2	2.3	2.6	3.1	2.6
Net domestic product	2.9	3.9	2.8	2.5	3.4	3.3	0.9	1.5	2.0	3.1	2.5

Real income measures (b)	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Real gross domestic income	3.5	5.6	4.9	5.0	5.3	4.9	3.2	1.1	6.5	3.5	0.6
Real gross national income	3.3	5.5	3.9	4.8	4.6	5.3	3.8	0.7	6.5	4.6	1.2
Real net national disposable income	3.0	5.5	3.6	4.6	4.4	5.2	3.4	-0.3	6.9	4.5	0.6
Real net national disposable income per capita (b)	1.8	4.2	2.3	3.1	2.8	3.3	1.2	-2.1	5.5	2.8	-1.2

Current price measures	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
GDP	6.1	7.3	7.1	8.0	8.9	8.5	6.7	3.0	8.6	5.0	2.5

Productivity	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Hours worked	2.7	2.0	2.3	2.3	2.9	3.0	1.1	0.0	2.6	1.6	0.4
Hours worked market sector (d)	2.1	1.7	2.7	1.5	3.1	3.1	0.2	-0.4	2.1	0.9	0.2
GDP per hour worked	0.5	2.1	0.9	0.8	0.9	0.7	0.5	2.1	-0.2	1.8	2.4
GDP per hour worked market sector (d)	1.1	3.0	0.6	1.7	1.0	1.2	1.0	2.7	0.5	2.2	2.3
Real unit labour costs	-0.6	-1.2	0.5	-0.6	-0.1	0.0	-3.1	0.2	-1.5	1.2	0.4
Real unit labour costs - non-farm	-0.9	-0.9	0.6	-0.6	-0.9	0.4	-3.2	0.4	-1.1	1.2	0.5

Prices	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Terms of Trade	1.5	7.4	9.6	10.8	7.2	5.5	7.6	-4.0	20.5	0.4	-9.7

(Continued next page)

Table 4. (Continued)

Chain volume GDP and related measures (b)	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
GDP ($m)	1,107,425	1,153,355	1,190,111	1,226,323	1,272,776	1,320,746	1,342,514	1,370,540	1,403,888	1,451,824	1,493,171
GDP per capita (c) ($)	56,020	57,641	58,772	59,699	60,982	62,121	61,787	61,935	62,599	63,698	64,398
GDP market sector (d) ($m)	772,669	809,142	835,739	862,571	897,846	936,685	947,923	969,479	994,820	1,025,727	1,052,,024
Net domestic product ($m)	970,523	1,008,636	1,036,424	1,062,548	1,098,652	1,135,430	1,145,456	1,162,712	1,185,818	1,222,964	1,253,201

Real income measures (b)	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Real gross domestic income ($m)	983,738	1,038,459	1,089,044	1,143,973	1,204,271	1,263,465	1,303,785	1,318,604	1,403,888	1,453,190	1,462,548
Real gross national income ($m)	956,551	1,009,156	1,048,848	1,099,639	1,150,537	1,211,727	1,257,971	1,266,909	1,349,736	1,411,184	1,427,871
Real net national disposable income ($m)	816,820	861,556	892,160	932,970	974,481	1,025,294	1,059,894	1,057,164	1,130,125	1,180,657	1,187,151
Real net national disposable income per capita (c) ($)	41,319	43,057	44,058	45,418	46,690	48,224	48,780	47,773	50,392	51,800	51,200

Current price measures	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
GDP ($m)	800,936	859,635	920,969	994,968	1,083,303	1,175,321	1,254,293	1,292,315	1,403,888	1,474,291	1,510,917
GDP per capita (c) ($)	40,516	42,961	45,481	48,437	51,904	55,281	57,727	58,400	62,599	64,683	65,163
Gross national income ($m)	778,651	835,305	886,913	956,338	1,034,912	1,127,182	1,210,221	1,241,689	1,349,736	1,431,698	1,470,453
National net saving ($m)	41,427	51,817	51,018	65,810	70,698	83,831	111,665	87,901	125,742	143,170	124,503
Household saving ratio	-1.0	0.7	0.5	0.2	3.6	4.2	9.6	9.2	10.5	10.4	10.6

Source: http://www.abs.gov.au/websitedbs/CaSHome.nsf/Home/Economy+Datasets

(a) Percentage change on preceding year.
(b) For years 2004-05 to 2011-12, the reference year for chain volume measures and real income measures is 2010-11. For years 2002-03 & 2003-04, the reference year for chain volume measures and real income measures is 2008-09
(c) Population estimates are as published in the Australian Demographic Statistics (cat. no. 3101.0) and ABS projections.

Table 5. Using the six-step framework for Interpreting the table that displays the Annual Gross Domestic Product (GDP), Measures over time, 2002-03 to 2012-13 (financial yearly)

Step 0: Why was the data collected?
Q: What was the purpose of collecting those data? **Q**: Can the data be categorised in other ways?
Step 1a: Getting started
Q: What is the general topic being examined? **Q**: Look at the column labels: what is being compared? **Q**: What do the columns represent? **Q**: What do the row labels reveal about what is being measured?
Step 1b: Data quality
Q: What are the source and credibility of the data? **Q**: What is the release date of the data?
Step 2: WHAT do the numbers mean?
Q: What does GDP per capita mean? **Q**: What does GDP market sector mean? **Q**: What is the meaning of GDP market sector measure during 2011-12? **Q**: What does real gross national income during 2012-13 mean? **Q**: What is the meaning of the -3.2 for real unit labour costs-non-farm during 2008-09? **Q**: What is the meaning of -9.7 in 2012-23 on the column of terms of trade?
Step 3: HOW do they differ?
Q: Which year has the highest real gross national income? **Q**: Which year has the highest net domestic product? **Q**: For how many years is the household saving ratio a negative number? **Q**: Which years had the highest and lowest values for "per hour worked market sector"?
Step 4: WHERE are the differences?
Q: Consider the real income measures. Compare the real income measures during different years. What do you notice? **Q**: Compare the household saving ratio in 2002-03 to the household saving ratio in 2012-13. What do you notice?
Step 5: WHY do they differ?
Q: Look at the years that the household saving ratio is negative. What do you notice? **Q**: Give some reasons for the differences in real unit labour costs, taking into account what you know about the economy and developmental levels of Australia.

Concluding points

The open data movement has provided unprecedented access to authentic, large-scale data sets on a wide range of socially important topics, but competent use of large-scale data predominantly requires comprehension of data tables, which are routinely used in daily life and in the workplace to communicate information about large data sets. This article has discussed how to implement a framework for helping students develop better ability to interpret large-scale data tables, in particular by using strategies that make comparisons between and within the categories of data and by drawing inferences about data within its context while making any reference to the contextual factors.

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