Faculty of Education

Assignment Cover Sheet

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Signed John Middendorf Date May 31, 2011

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Critical Numeracy in the Media--Percentage

Percentages are widely used, and often misused, in the media, and are expressed as numerals followed by the term "per cent". The term "per cent" derives from the Latin root "cent" (100) and a percentage represents a proportion of the whole; for example, 1 per cent literally means 1 per 100.

Percentages in the media are often used to summarise and to provide a general sense of proportion, and to avoid exposing the reader to the actual numbers pertinent to the factual aspects of the story. In fact, the *BBC News Style Guide* specifically recommends, "A story with too many figures numbs the listener. Simplify wherever you can, round up or down, and try to tell the story without getting bogged down in numbers" (Allen, n.d., p. 51); this philosophy can often lead to oversimplification and ambiguous reporting in the media.

Percentages in the media are primarily used in one of two ways: to represent a proportion of the whole, and to represent a relative value from one instance to another. For my examples, I have chosen one of each of these instances using the same theme--deforestation--to formulate a lesson plan of critical numeracy in the media.

The first example cites a nebulous percentage of a whole that has been repeatedly referenced and misused in various Australian media articles on an issue regarding Tasmania forests. The second example analyses an article from *The Economist,* which describes a percentage increase in deforestation in the Brazilian rainforest; though the journalist qualifies the percentage as suspect in the text of the article, by examining the source data, the reader can gain a deeper understanding.

Example 1: Percentage as part of a whole

The following article (Figure 1) appeared in the Mercury on April 13, 2011 and is evidently derived from an April 12, 2011 press release from Forestry Tasmania entitled, *Working to Deliver Outcomes from Forestry Peace Talks*. The original press release says, "Mr Green said that about 98 per cent of the 572,000 hectares was now effectively under a moratorium" (Green, 2011).

Most forests protected under moratorium: minister

Mercury, April 13, 2011 p.11

TASMANIAN Resources Minister Bryan Green has told Parliament 98 per cent of Tasmania's high-conservation-value forests are now protected by a moratorium on logging.

Mr Green said the protection of a large part of the 572,000ha of Tasmania's native forests classed as high-conservation-value by environmentalists, showed Forestry Tasmania was committed to ending logging conflict.

Mr Green said: "The remaining 2 per cent [of forest still being logged] is required to maintain supplies. This is complex and has required a bit of work to ensure that Forestry Tasmania can meet all its obligations, particularly to the sawmilling and veneer industry."

Wilderness Society spokesman Vica Bayley said no moratorium existed while 2 per cent of the state's most significant forests continued to be logged.

He also questioned whether the high number of large log trucks on Tasmania's roads was evidence that logging is actually continuing at a greater, rather than a reduced, pace as the Kelty roundtable peace talks continue.

Figure 1 (Source: *The Mercury*, April 13, 2011).

Subsequent media articles continue to reference the percentage. On May 16, the Forestry Tasmania spokesman Ken Jeffreys cites that Forestry Tasmania "has put into effect a six-month moratorium over 98 per cent of the area claimed by environmental groups as having high conservation value" (2011). In *The Age*, Tasmanian Premier Lara Giddings is quoted as stating, "the state government had protected 98 per cent of high conservation value forests" (Darby, 2011).

The repeated references to "98 per cent" and indeed, the title of the *Mercury* article, "Most forests protected under moratorium," infer that the HCV forests are under special protection. However, by providing an additional fact unmentioned in the media, it is possible to critically analyse the media's reporting.

Example 1 Student Questions

1. The *Mercury* article (Figure 1) uses percentage as a part of a whole. Identify the hectares of forest representing the whole, and the percentage that is "still being logged" (i.e. unprotected).

Answer: Whole=572,000 hectares. Percentage= 2 per cent.

2. Calculate the hectares of high conservation value (HCV) forest that are unprotected during the six-month moratorium.

Answer: 572,000 hectares x 0.02 = 11,440 hectares.

3. Using the chart provided by Australian Government (Figure 2), identify the average annual total harvest area from Tasmania State forests (in hectares), and compare this area with the HCV hectares unprotected during the moratorium. Are the two values significantly different?

Answer: Average hectares logged per year in Tasmania: 11,500 hectares. Hectares in HCV forest unprotected during the moratorium: 11,440 hectares.

Harvesting from multiple-use forest; areas available and annual average areas harvested (hectares)[a]

State[b]	Area available[c]	Area clearfelled & regenerated	Area thinned or partially felled	Total harvest area	Proportion harvested %
New South Wales	1 470 000	0	43 500	43 500	3.0
Tasmania	890 000	4 800	6 700	11 500	1.3
Victoria	922 000	4 900	2 900	7 800	0.8
Western Australia	848 000	430	8 820	9 250	1.1

Notes:

a Annual averages generally for previous five years. Areas of forest cleared from mine sites are not included.

b Information for Queensland is incompatible with the reporting format. Native forest timber harvesting in Queensland on State-controlled lands occurred on about 23 000 hectares in 2009–2010. There is no multiple-use forest in the Australian Capital Territory, Northern Territory and South Australia.

c This is the State forest area available for timber harvesting after excluding areas reserved by management plans and regional forest agreements. Timber harvesting is excluded from additional parts of the available areas to meet regulatory requirements to protect flora, fauna, catchment and other values.

Figure 2 (Source: *Australia's forests at a glance*, Australian Bureau of Agricultural and Resource Economics and Sciences, 2011).

4. Consider the *Mercury's* headline of "Most forests protected under moratorium." Does the headline properly reflect the intent of a moratorium intended to limit the harvesting of native forest? Can you think of a less misleading headline?

Possible answer: Clearly, the headline is misleading as it infers that the 'protection' arises from the moratorium, whereas the reality is that the 2 per cent in HCV forests (a subset of the total State forest area) that is open for logging is nearly equal to the average annual harvest. A more genuine headline might read: "11,440 hectares of HCV forest unprotected during moratorium".

Reflection Example 1

The questions are designed to lead students through the 3-tier hierarchy of critical numeracy. Question 1 identifies the terminology used in the article, and how the part relates to the whole by decoding the provided percentage figure and the whole. Questions 2 and 3 put the percentage terminology in context by first requiring the calculation of the value of the part in the same units of the whole, and then, by providing one additional fact (the average value of State forests harvested in Tasmania per year), the part can be compared and put into context. Question 4

returns the student to the reading of the article by specifically questioning the headline, thereby encouraging critical thinking by comparing the apparent meaning of the headline to the implications of the actual data provided. Through this process, the headline is exposed as misleading and erroneous. A follow up and review to the lesson could be to provide the original quote from Minister Green's press release referenced above (which is disingenuous, but not dishonest), and to analyse the intent of *The Mercury*'s writer and editor as they composed the article and the headline.

Example 2: Percentage as an increase

The following article (Figure 3) appeared in *The Economist online* on May 26, 2011.

Deforestation

Chopping down the Amazon

May 26th 2011, 15:38 by The Economist online

Making sense of the numbers on the Brazilian Amazon

UNDERSTANDING what is happening to the world's largest tropical forest is hard: efforts to monitor deforestation in the Amazon are hampered by cloud cover, which can prevent satellites from getting a full picture of what's happening on the ground. The numbers also tend to ping around month by month, prompting alarm among conservationists one month and triumphalism from Brazil's government, which tries to prevent illegal logging, the next. The most recent release from Brazil's National Institute for Space Research showed a 473% increase in deforestation during March and April 2011 compared with the same period last year. This sounds alarming, and it may well turn out to be so. But it also comes in the context of falling deforestation. It will probably be a couple of years before it is possible to tell for sure whether the government's proposal to regularise land tenure in the Amazon region is resulting in more active chainsaws there.

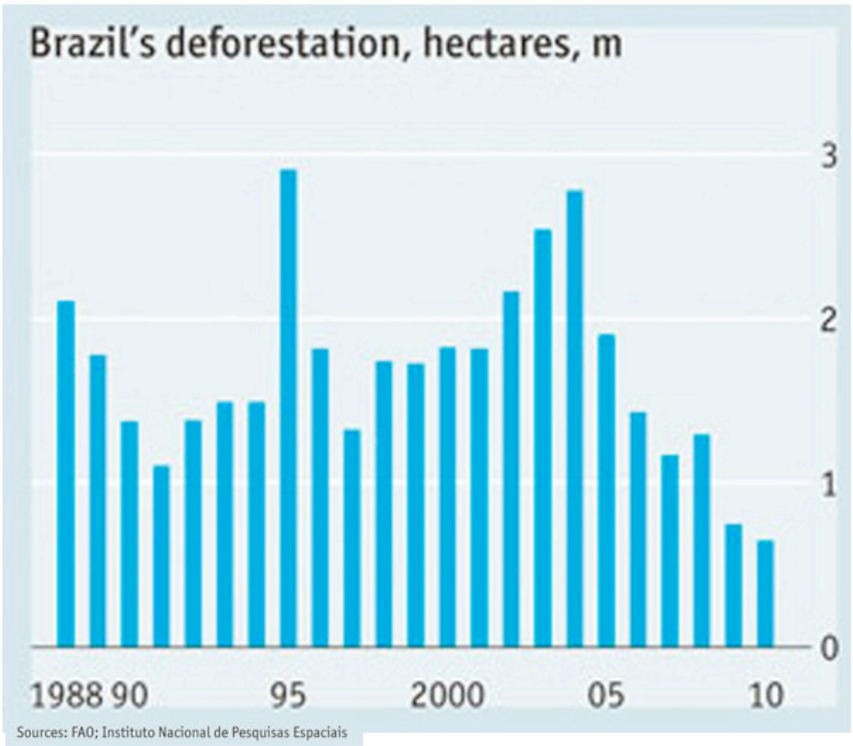

Figure 3 (Source: *The Economist Online*, May 26, 2011).

Example 2 Student Questions

1. After reading the article in Figure 3, discuss the significance of the 473 per cent increase, and discuss what is meant by the qualifier in the article, "But it comes in the context of falling deforestation." Is there any additional information that would provide a better understanding of the percentage increase?

Possible answer: 473 per cent is a large increase. In the context of falling deforestation, the original amount (that the percentage increase is based on) may be a small number. Knowing the actual values of deforestation for the periods cited would be helpful to put the increase in context.

2. The *Economist* article (Figure 3) references the Instituto Nacional de Pesquisas Espaciais (INPE) as the source, which provides data from the Brazilian remote sensing device DETER (a Portuguese acronym for "Detection of deforestation in real time"). An Internet search reveals the source data for the March-April 2011 period (Figure 4). Study the note about the DETER data and suggest why the percentage increase value might be suspect.

Possible answer: The cloud cover during the DETER observation varies from month to month and affects the measurements; the INPE specifically discourages making comparisons such as the one made by the Economist. The percentage is based on the comparison of same period in the preceding year, but the March-April 2010 reading could have been very low due to cloud cover.

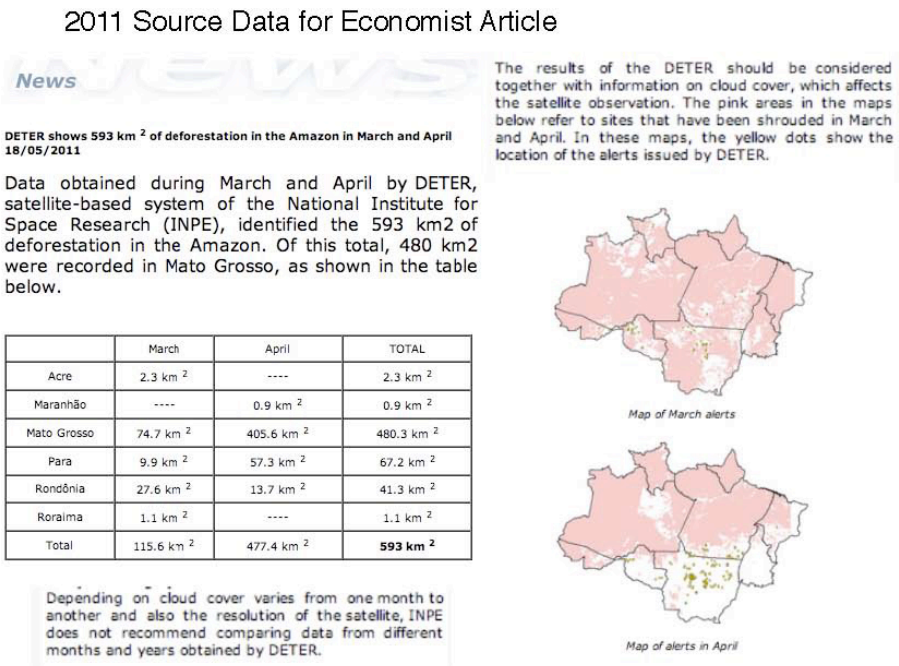

Figure 4 (Source: DETER, 2011).

3a. Approximate the total annual deforestation (in hectares) in 2010 from the chart in *The Economist* article (Figure 3). Convert this value to square kilometres by dividing by 100 (1 sq. km = 100 hectares).

Answer: approximately 600,000 hectares (6000 sq. km.) deforestation for 2010.

3b. Approximate the monthly average deforestation in 2010 by dividing the total annual deforestation by 12 (months).

Answer: approximately 500 sq. km. average deforestation per month for 2010.

3c. Find the total measured deforestation for the March-April 2011 period listed on Figure 4. Round this value up, then determine the monthly average for March and April by dividing this value by 2 (months). Compare the monthly average for March-April 2011 with the monthly average for 2010. With this in mind, does the spike in March-April 2011 affirm or weaken the notion of an increasing trend in deforestation?

Answer: 300 sq. km monthly average for March and April, 2011, vs. 500 sq. km. monthly average for 2010.
There is not enough information to determine if the March-April spike signifies an increasing trend. Even with the large percentage increase from March-April 2010 to March-April 2011, the monthly rate of deforestation for that part of the year is less than the monthly 2010 average--most likely the most deforestation happens in other seasons that would be more significant in terms of the overall rate of deforestation.

4. (Extra credit). Using this source value for March-April 2011 (593 sq. km.) and the percentage increase from 2010 (473 per cent), calculate the amount of deforestation in the corresponding March-April 2010 period, using the formula below:

$$2010value = \frac{2011value}{\frac{PercentIncrease}{100}+1}$$

Answer: 105.5 sq. km. deforestation was measured in March-April 2010.

Reflection Example 2

The purpose of this example is to expose the student to percentage increases in a real world example. Even though the article has caveats regarding cloud cover and hints about considering the context in terms of an overall trend of falling deforestation, the 473 per cent figure indeed seems "alarming". By exposing the source data on which the article is based, the student can analyse and decipher the meaning behind the article's caveats.

Responses

I provided the examples on percentage to two people (person "A" and person "B"). For the first example, both read the article, and then were able to identify the terminology of the part (2 per cent) and the whole (572,000 hectares). Next they calculated the total unprotected HCV forest (11,440 hectares).

In terms of terminology in context, Person B was initially confused by the additional numbers and percentages on the chart (Figure 2), and tried to make sense of the 1.3 per cent listed on the chart with the 2 per cent referenced in the article. In addition, because Person B was familiar with the Tasmania forests issue (though not of this particular article), he understood that the clearfelling of the HCV forests was the primary issue, so he focused on the 4,800-hectare figure. However, upon further study, both were able to see that the total annual average harvest area (11500 hectares), and total unprotected HCV forests (11,440 hectares) were essentially the same, and the terminology in context became clearer.

Critical thinking and questioning of the examples occurred with the final question. By thinking of an alternate headline, they were both able to discern the fallacy of the oft-quoted 98 per cent figure. Person A's headline was "The cutting of our forests remains the same under the moratorium". Person B's headline was "Business as usual for forestry." In response to the Mercury headline, Person A focused on the small difference of 60 hectares per year, and said, "Most forest *isn't* protected under the moratorium--at most, only 60 hectares could be." Person B elaborated further and said, "The headline is bunk because there's not more forest protected because it's almost the same amount, and that includes plantation" (plantation forests are not representative of HCV areas).

Overall, it was a successful example. Both were initially suspicious of the kind of claim made by the newspaper, but the questions led them to a better comprehension of the disingenuous use of percentage and the misrepresentative headline.

For the second example on the Brazilian deforestation, both individuals were able to identify the terminology and put them into context, by understanding that a large increase in deforestation took place between the two months measured in 2010 and

2011. Upon initial reading both individuals were confused by the meaning of the writer's comment, "But it comes in the context of falling deforestation." Perhaps one would need to be more mathematically intuitive (or be an economist) to immediately understand the implications of such a statement. However, after working through the subsequent questions, both were able to understand the effect of a lower baseline on a percentage increase.

After studying the source data in Figure 4, both understood that the source data was highly dependent on the cloud cover at the time of measurement. Person B asked me to identify the state of Mato Grosso in the map in Figure 4 (which shows little cloud cover in April), and then he immediately made the connection between the map and the large values of deforestation recorded for that month for that state. Person A dislikes math intensely, so I assisted her with the third part, which requires some mental calculation. However, after seeing the numbers, she could discern that what initially seemed like a large area of deforestation (600 sq. km.) did not seem as large when taken in context. At one point, she said, "It's like a puzzle." Overall, the goal of encouraging critical thinking was achieved, as both better understood the context of the large percentage increase of Brazilian deforestation after answering the questions. Person B reread the original article afterwards and commented that the caveats the author included were much clearer. He said, "Straight away I was suspicious of that number (the percentage), but now I see what it means."

Reflection

Luke and Freebody (1990) outline a "four resource model" for literacy where an "effective reader has to adopt four roles: code breaker, text participant, text user, and text analyst (as cited in Campbell and Green, 2006). In a presentation for the National Literacy and Numeracy Week in New South Wales, Dr. Jane Watson said, "the Framework for Critical Numeracy has affinities with Luke and Freebody's claims for Critical Literacy for readers" (Watson, 2011, p. 2). With this concept in mind, the teacher can provide focus on the precursor tools of critical thinking, namely, the code breaker (decoding and using terminology) and user and participant aspects (terminology in context). With a better comprehension of these building blocks, students can be more readily prompted to the role of the critical analyst with cues and questions.

Critical thinking is a component of the Australian Curriculum. It is considered a "general capability" along with literacy, numeracy, ethical behaviour, and ICT competence (Shape of the Australian Curriculum, 2010). It can be taught in all disciplines, but in math and science the strategies can be demonstrated the most explicitly. Seeking ways to link critical thinking skills utilising a cross-curriculum approach becomes a core challenge for teachers.

Critical thinking is both a process and a product (McLean, 2005, p. 2). The product is the "ah ha" moment when a thought has been clarified and understood. The product is personal and cannot be transferred from one person to the next; however, the process can be learned through encouraging a healthy scepticism by questioning assumptions and frequently reflecting of the implications of new concepts at the learning stage. The development of critical thinking abilities have been linked to Kohlberg's and Piaget's theories (Weinstock, Assor & Broide, 2009). As children move from a heteronomous morality (following rules) to an autonomous morality, and from a preoperational to the concrete and formal operational stages, it is natural that they will also be making their own judgements and internal "rules", which are also core critical thinking and problem solving skills. By being aware of these stages, the teacher can optimise lesson plans that encourage creative thought and innovative pathways to understanding.

In our readings of *The Tiger That Isn't* (Blastland and Dilnot, 2006), which primarily involved the health care industry in the United Kingdom, we were exposed to numerous examples of media and organization "spin". We discovered many examples of plausible statements and "common knowledge" which, once scrutinized with critical thinking and a logical analysis, became quite obvious fallacies and misrepresentations. The examples tend to suggest that if any claim or statement seems startling or extraordinary, it is time to drop one's biases and begin an objective review process. As the authors conclude in their book, "we are all capable of detecting (fallacious arguments). Think twice."

In today's digital world, with access to inestimable sources of information, an individual needs to be highly discerning when it comes to the media. For both my examples, I provided one additional piece of reliable source information that was

available via the Internet; without the additional information, it would not have been possible to make a clear judgement of the original text at face value. Yet the Internet is a double-edged sword when it comes to reliable information--though facts can be quickly researched and verified, misinformation can also be proliferated and reinforced. In my search for the source information for the Brazilian deforestation article, I found dozens of references to the "473 per cent" increase in deforestation based on the same source data, many of which, unlike *The Economist's* reporting, were wildly taken out of context and presented as "proof" of a wholesale and sudden destruction of the Amazon rainforest. Though books and libraries tend to become secondary considerations in today's fast-paced digital world, it is vital to teach the traditional ways of research by chaining source references and seeking root sources of information; this involves a fastidious analysis and reporting of sources. Becoming a discerning researcher involves two components which can be taught and learned: (1) developing an acute internal trigger to know when to question a "fact" or a statement, and (2) accurately identifying, searching, and evaluating the appropriate sources to verify, dismiss, or elucidate a questionable statement. Such skills require critical thinking skills based on a broad cross-curriculum understanding.

When person A commented on one of my examples, "It's like a puzzle," I felt immediately rewarded, as my strategy when creating the questions was to encourage a problem solving approach, which generally involves simplifying the nature of a problem, then using a repertoire of acquired tools to solve a new and unfamiliar problem. Yet there are many pathways; my goal as a teacher is to consider the different ways students think and grasp knowledge, then engaging them creatively to encourage them to become self-sufficient critical thinkers.

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