Statistical Literacy: Humanistic Education for the Future
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Abstract: The qualitative/conceptual reasoning used in the humanities is being pushed aside by the quantitative/observable reasoning used in the social sciences. Statistical comparisons seem as immutable as basic arithmetic. But social statistics are numbers in context. Most social statistics are subject to context in the same way that ideas involving the human condition are. For example, the UK National Health Service found that among COVID cases, the vaccinated were more likely to die than the unvaccinated. But after taking into account age, the comparison reversed: the unvaccinated were more likely to die. Statistical literacy teaches students to focus on what was – and was not – taken into account. Statistical Literacy is critical thinking about everyday statistics as evidence in arguments: how statistics are constructed and manipulated. Students are taught how to think hypothetically about how things may have been defined, counted, measured, compared and presented. Statistical literacy doesn't require computer software; it uses ordinary English to distinguish association from causation and to describe and compare conditional probabilities. Instead of Algebra, it uses basic arithmetic and weighted averages. It has less than a 30% overlap with traditional introductory statistics. Half of those taking statistical literacy said it did more to develop their critical thinking than any other course they had taken. This paper summarizes the highlights of Statistical Literacy (Math1300) as a mathematics course satisfying a general education requirement at the University of New Mexico. Educators in the humanities are encouraged to promote the adoption of Statistical Literacy for their students.

Introduction:

Statistical literacy. The word 'statistical' may turn off many of those in the humanities. But stay focused on the word 'literacy' in this presentation. Our goal is to see the story behind the statistics.

This presentation is organized into five parts:

1. Humanities Problems 1970 – 2000. Lost ground.

2. 2002 New Directions in the Humanities (NDIH) Conference first held.
   2023: Humanities lost more ground.

3. "Objectivity" of the Social Sciences

4. Progress: Statistical Literacy: A New Discipline

5. Statistical Literacy (Math 1300) at the University of New Mexico

1. Humanities Problems 1970 – 2000

The "humanities, those branches of knowledge that concern themselves with human beings and their culture or with analytic and critical methods of inquiry derived from an appreciation of human values and of the unique ability of the human spirit to express itself. As a group of educational disciplines, the humanities are distinguished in content and method from the physical and biological sciences and, somewhat less decisively, from the social sciences. The humanities include the study of all languages and literatures, the arts, history, and philosophy."   Encyclopedia Britannica.

The humanities faced many problems in the 30 years between 1970 and 2000.

Students' interests and values changed as shown in the left side of Figure 1.
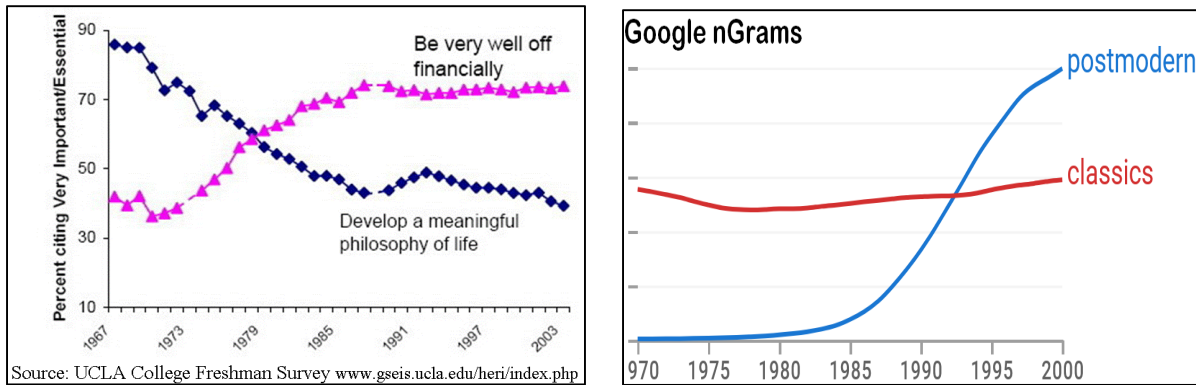

Figure 1: Materialism versus meaning: Classics vs. postmodern

Developing a meaningful philosophy of life was cut in half: dropping from 80% to 40%. Being well-off financially doubled: increasing from 35% to 70%.   Both of these changes are headwinds for the humanities; tailwinds for those in business, the physical sciences, and the social sciences.

There were changes within the humanities. Google nGrams shows how frequent these words are in the right side of Figure 1.   The frequency of the word 'classics' is steady, while the frequency of the word 'postmodern' increased dramatically between 1985 and 2000.   Yes, we know that postmodern was in use long before 1985, but its usage increased greatly after 1985.

A major event occurred in 1996. Sokal submitted this paper: *Transgressing the Boundaries: Toward a Transformative Hermeneutics of Quantum Gravity.* His paper was a meaningless farce. His submission was a hoax.

Gontarski (2004) noted, "*Its publication and the subsequent furor it generated   offered the most serious challenge to research in the humanities in the past half century.*"   He argued that the Sokal affair meant that humanities research would be seen as frivolous and lacking intellectual or academic standards.

The focus on post-modernism is seen by some as undermining the role of the humanities. Payne (2004) argued as follows: "Because of the critical assault on humanism by such theorists as Lacan, Derrida, and Foucault, humanism would seem to be in disarray."   Spacks (2002) cited this disarray as a reason for forming the American Academy of Arts and Sciences.

There were many other external forces undermining the humanities as shown in Figure 2. All of these raised questions about the ability of the humanities to discern what was true or good.
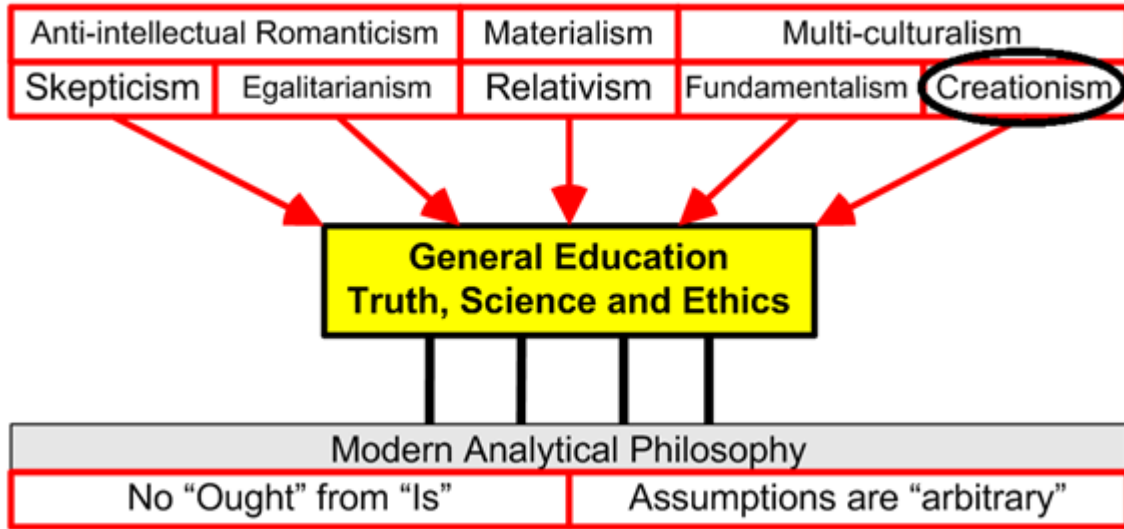
Figure 2 Humanities under Attack (Schield 2009)

Meanwhile the humanities were seemingly undermined internally by philosophy. It seems that the normative fallacy, first introduced in 1903 by G. E. Moore was being interpreted as saying it was impossible to use descriptive statements to justify evaluative (normative) claims. This seemed to undermine the ability of the humanities to make any secular claim as to what things or actions were good.

Simultaneously, philosophy was strongly influenced by mathematics where it seems that all premises, all assumptions, are arbitrary. One could start with human kind arising by evolution; one could start with human kind arising from their creation by a God. There was no way to argue about a starting point.

During the 30 years between 1970 and 2000, degrees conferred in English Literature, the core of the humanities, lost ground: a 20% decreases from 64, 000 to 35,000. See the left side of Figure 3. This 20% decrease in enrollments is arguably a result – in part – from these internal and external changes. The decrease is even larger when measured against total number of degrees awarded (dashed line scaled).
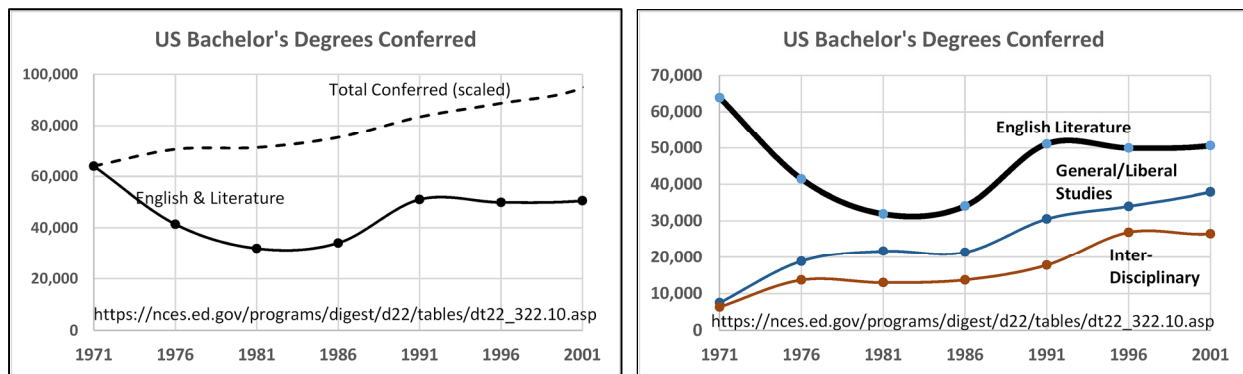

Figure 3: 1970-2001, English and Other Degrees Conferred

The right side of Figure 3 shows in impact of another causal factor: the rise of competitive majors such as Liberal Studies (Liberal Arts) and Inter-disciplinary studies. "As a discipline, these subjects are intended to give you general knowledge and the ability to think critically and learn any subject — instead of specific skills needed for a technical profession." "A liberal arts degree studies history, literature, writing, philosophy, sociology, psychology, creative arts and more. Liberal arts programs are designed to help you formulate compelling arguments, communicate well and solve problems." LaBoef (2022).

2. To Address this Disarray: 2003

To address this disarray, Monash University in 2003 organized New Directions in the Humanities.

> "The Humanities Conference aims *to develop an agenda for the humanities* in an era otherwise dominated by … rationalisms. What is the role of the humanities? This conference will reopen the question of the human for pragmatic and redemptory reasons."

In the 2004 conference in Prato Italy, more than 850 papers were presented. Several of these lamented the demise of the classics.

Walsh (2004), a classics professor at Loyola College in Maryland, argued in support of studying the Greeks. He agreed with Newman who thought we should focus on the Greeks because "their writings are so unsurpassed in their ability to help us understand how to lead our lives." Walsh concluded that such a defense would be most unlikely today since academics must not assert anything that would "privilege one culture over another."

As shown in Figure 4 (left side), the degrees conferred in English & English literature have continued to decrease: a 50% decrease since 1971. As shown on the right side, degrees conferred in Liberal studies and in Multi-disciplinary studies have increased and now surpass those conferred in English & Literature.
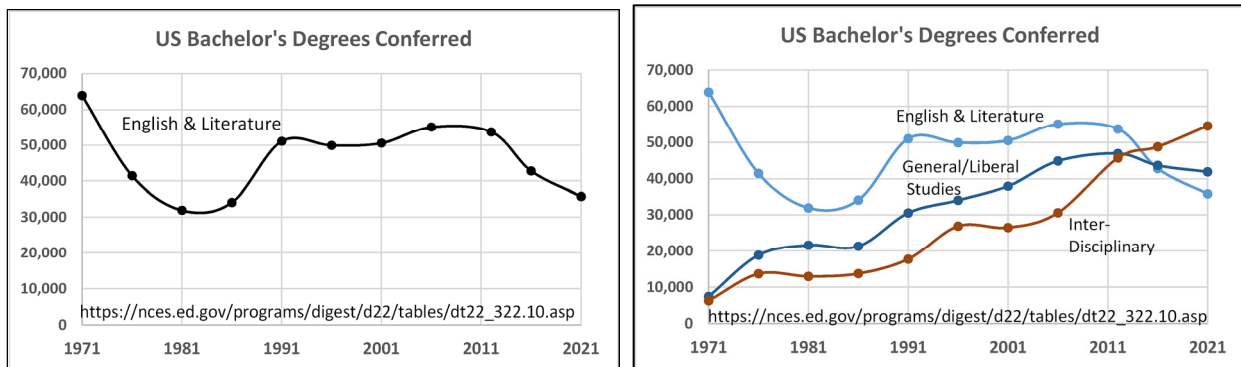

Figure 4: 1970-2021, English and Related Degrees Conferred

Between 1971 and 2021 (Figure 5), degrees conferred increased substantially in Health (963%) and Business (240%), increased slightly in the Social Sciences (4%) and decreased in Education (49%). Meanwhile, degrees conferred increased substantially for the four "young tigers": Biological Sciences (270%), Psychology (230%), Communications (780%) and the Performing Arts (200%).
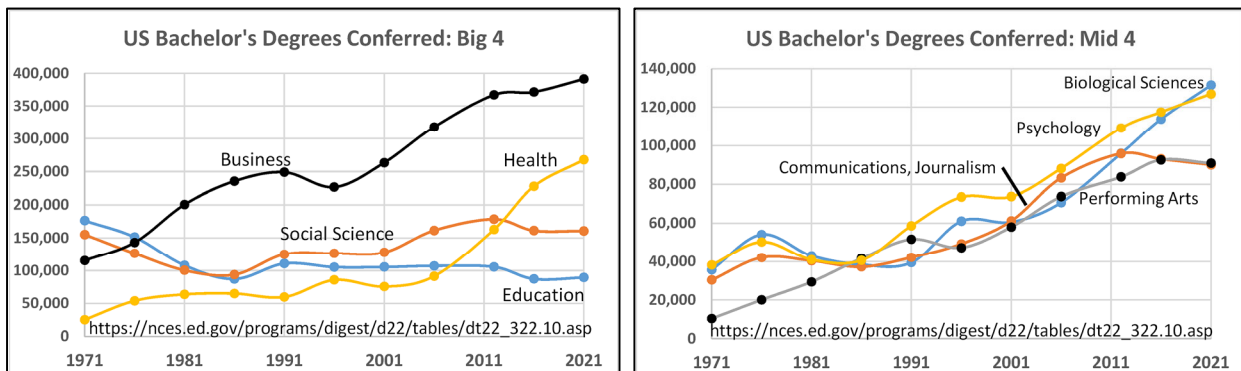

Figure 5: 1970-2021, Degrees Conferred in Business (Big 4) and Biology (Mid 4)

3. "Objectivity" of the Social Sciences

Degrees conferred in the social sciences and history (161,000 in 2021) far outnumber those in English Literature (38,000). Of course the social sciences include three multiple disciplines: Sociology, Economics, and Social Work. More importantly, the social sciences can identify and measure social problems and recommend solutions using quantitative measures and scientific methods. This means students are much more likely to get jobs than if they graduate with a degree in English Literature.

An outsider might conclude that the academy doesn't really care about English Literature. It may be seen to be lost in antiquity with little relevance to modern times. Meanwhile, the social sciences seem more scientific, more "now".

A big difference between English Literature and the social sciences is the role of numbers. Statistics seem to give the social science 'objectivity' while the focus on words used in English literature make it seem much more 'subjective'.

Faculty and students in the humanities don't know how to evaluate the apparent "objectivity" of the social sciences. They know how to analyze and evaluate inductive arguments using strength of evidence. But the quantitative arguments of the social sciences appear to be either descriptive or deductive.

But, the "objectivity" of the social sciences is all-too-often a facade: a false front that seems immune to any kind of evaluation. You don't evaluate statements like "one plus one is two".

The Social Sciences tend to ignore or minimize four internal problems:

- Statistics are different from numbers
- Statistics can be influenced – confounded – by related factors
- Statistics can be influenced by how they are assembled: defined, grouped, compared, etc.
- Statistical arguments often contain a hidden premise or unstated conclusion.

Humanities faculty and students need training to see these problems. Unfortunately taking the typical introductory course in statistics (taken by most college graduates) will not focus on these problems. Introductory statistics is mathematical: deductive reasoning about numbers.

Statistical literacy focuses on each of these four problems.

4. Statistical Literacy

Statistical literacy is a new discipline. Statistical literacy is critical thinking about everyday statistics used as evidence in arguments. Most everyday statistics are based on observational studies where confounding has more influence than randomness.

Most US college graduates have taken statistics 101. They never study "after taking into account". Only those who take the second course in statistics will learn about this mental operation.

Statistical literacy is different. Statistical literacy has less than a 30% overlap with traditional statistics.

Statistics: Four Important Things	
1	Statistics are numbers in context
2	Statistics can be influenced
3	Statistics are socially constructed
4	"Take Care" with statistics

Figure 6: Four Important Features of Statistics

Statistical Literacy addresses four weaknesses in the Social Sciences:

1. Statistics are different from numbers. In arithmetic, one plus one is always two.   But that's not necessarily true for statistics. Statistics are numbers in context. In 'bunny-math', one plus one can result in more than two. In 'ice-cube' math, one plus one may result in less than two. Numbers describe ideas that very simple.   Statistics describe reality and reality is complex. Statistics are closer to words than to numbers.

2. Statistics can be influenced – confounded – by related factors. Among twenty-year olds, men weigh 20 pounds more than women – on average. This is a crude comparison: it doesn't take into account any related factors. Men are five inches taller than women on average. As height increases, weight increases. The difference in height influences – confounds – the difference in weights.

3. Statistics are socially constructed. Statistics can be influenced by how they are assembled: defined, counted, measured, summarized, compared and presented.   Here are some examples: (1) How many different kinds of pitches are there in baseball? The number ranges from two to almost a dozen. (2) How does the school principle define bullying? The definition strongly influences the amount of bullying in the school. (3) What is the criteria for being overweight? In 1998, 29 million Americans suddenly went from having a normal weight to being overweight without gaining any weight. The National Institute for Health changed the definition for being overweight.[1]   (4) A goalie has a 50% improvement in saves. Before training they blocked 40% of the shots. After training they block 60%: half more than 40%.   But if we look at the decrease in goals allowed it went from 60% to 40%: a decrease of a third (33%). So which is the better measure of improvement: 50% or 33%?

4. Take care when dealing with statistics. After 12 years of numbers, where the context doesn't matter, it takes practice to see statistics as being very different. Studies are a new kind of argument as presented in the next section.

Statistical Literacy studies Studies

'Studies show' is arguably a new form of argument.

The left side of Figure 7 shows the prevalence over time of three phrases: therefore, 'and so', and 'it follows that'. These phrases are commonly used in making a logical (usually deductive) conclusion. Notice that the latter (it follows that) is the least common of these three.

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[1] https://archive.nytimes.com/well.blogs.nytimes.com/2014/04/14/a-number-that-may-not-add-up/

The right side of Figure 7 shows the prevalence over time of four phrases involving the keyword 'studies': 'studies have shown', 'studies show', 'studies suggest' and 'studies have found'. There are other forms not shown such as 'studies indicate', etc. Note the tremendous increase in these phrases since the mid-1900s.
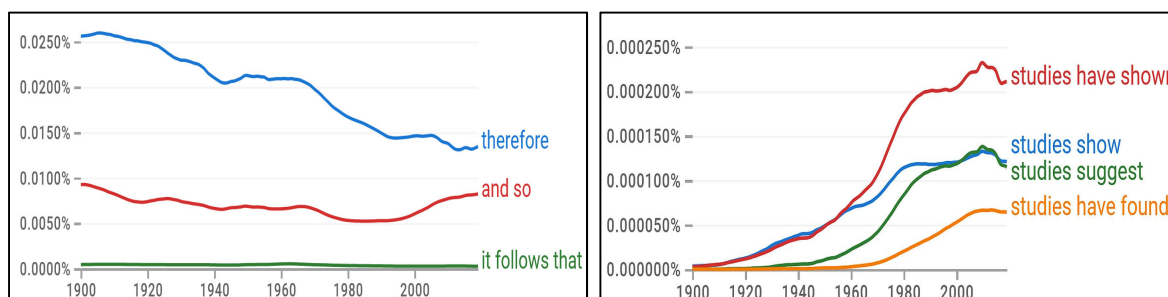

Figure 7: nGrams Logical connectors and studies

Figure 8 follows the prevalence of a single phrase (it follows that) and the sum of five closely related phrases: studies show, studies have shown, studies suggest, studies have found and studies indicate. These five are summarized as "studies5".

Figure 8 shows the prevalence of 'it follows that' and 'studies5': In 1900, the former was 68 times as prevalent as the latter. But by 2010, the order had reversed. The latter was 140% more common than the former.
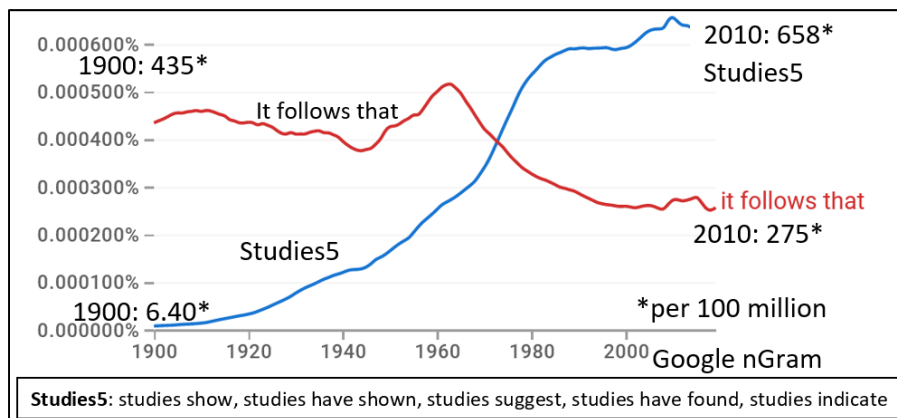

Figure 8: nGrams 'it follows that' versus 'studies5'

'Studies show' is arguably a new kind of logic. These statements aren't obviously deductive or inductive. They seem to be factual statements. Yet somehow they also seem to be making a claim that is disputable.

Faculty and students need a different kind of critical thinking course to untangle this new kind of logic: disputable conclusions presenting themselves as factual descriptions. How is this confusion possible?

Many – if not most – 'studies show' claims involve a comparison of crude statistics. These crude comparisons tell a half-truth; they prevaricate. We need to see the story behind these statistics! We need to understand what it means to "take something into account".

Statistical Literacy" Taking into Account

College graduates have a general idea of what it means to "take something into account" when it involves analyzing or evaluating a situation. They even understand what it means when comparing counts.

Example #1: A comparison of rates can have a different size and direction than a comparison of counts.

California can have more unemployment than Nevada, but Nevada can have a higher unemployment rate than California. This reversal is no surprise. The population of California (40M) is more than 10 times as big as the population of Nevada (3.2M). Taking into account the size of the population can change the direction in a comparison of counts.

When there is just one choice for a denominator the situation is fairly straightforward. But when there are multiple choices, the situation becomes more complex.

Example #2: The Diabolical Denominator. The choice of a denominator can change the size and direction of a comparison between two groups.

Which state has the higher Covid death rate? Start at the bottom of the pyramid. Per million population, Rhode Island (RI) has the higher death rate. Moving up one level: per million tests, Michigan has the higher death rate. At the top level per million cases, Michigan has the higher death rate. The choice of the denominator can change the size and direction of a comparison.
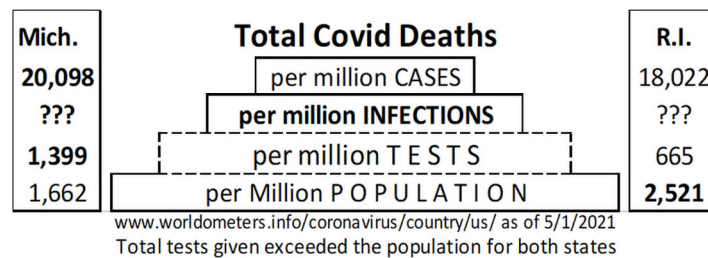

Mich.	Total Covid Deaths	R.I.
20,098	per million CASES	18,022
???	per million INFECTIONS	???
1,399	per million T E S T S	665
1,662	per Million P O P U L A T I O N	2,521

www.worldometers.info/coronavirus/country/us/ as of 5/1/2021
Total tests given exceeded the population for both states

Figure 9: Diabolical Denominator

So which one is right? Maybe none of them. You need to be infected before you can die from COVID. Many in the population (bottom level) or among those that are tested are not infected. Those denominators have too many people. Per case includes only those that tested positive. It omits those that were infected but never tested. That denominator is too small.

A better choice would be per million infections. Unfortunately that data is difficult to get and seldom available. So one must argue which of the three shown is the best.

Now return to the comparison of unemployment rates where there was a single denominator. Most educated people presume that once one has a ratio, that's the end. You can't go any further without computer software and advanced training in multivariate regression. That may have been true in the past, but it is no longer true in Statistical Literacy: Math 1300 at the University of New Mexico.

Example #3 Compare pay rates: "Women make 73 cents for every dollar a man makes."

This example involves arithmetic. But it shows how a comparison of ratios (averages) can change in size and'/or direction after taking into account a related factor: a factor that confuses – a confounder.

The 73 cents per dollar is a true statement according to the US Census Bureau in 2020 when comparing working men and women: people holding paying jobs. In that sense, it is a fact. The implication is that this fact is sufficient to justify a moral claim: this gender disparity is inequitable, unjust, wrong, and is one more example of sexual discrimination.

Yes, this biological disparity may be due to sexual discrimination. Statisticians have no expertise in assessing that claim or the hidden assumption that men and women are – on average – equal from the neck up. But statisticians have considerable expertise in seeing how a quantitative relationship based on an observational study (a crude comparison) can be influenced. Schield (2022b and 2022d)

In this case the influences are pretty obvious. Those holding full-time jobs tend to make more than those holding part-time jobs. Those holding permanent (year-round) jobs tend to make more than those holding temporary (seasonal) jobs. Note that 'full time' stands for full-time permanent.. Here is the data.[2]

Worker Income by Gender and Work Status					Row %
2020	ALL	Col%	Full Time	Other	FullTime
Male	49,389	100%	61,417	23,740	68%
Female	**35,838**	73%	56,287	7,742	**58%**
Difference	13,551	27%	5,130	15,998	
73% = 35,838 / 49,389			35,838 = **0.58***56,287 + (1 - **0.58**)*7,742		

Table 1: Worker Income by Sex and Work Status

The income of Female workers (35.8K) is 13.6K (27%) less than that of male workers (49.4K). But if we look at just those working permanent jobs full time, we see that the income of female workers (56.3K) is just 5.1K (15%) less than that of male workers (61.4K). And if we look at all other workers, we see a bigger disparity: 16K (67%) less.

The far right column shows the percentage of workers for each sex who are working 'full time'. So, 68% of these men work full time (58% of these women).

In order to take into account this related imbalance, we need to standardize. We need to give both groups the same mix – the same percentage of workers who are working 'full-time'. In this case, we give the female workers the same mixture, the same percentage who are working full time, as the male workers

Worker Income by Gender and Work Status					Row %		Worker Income	
2020	ALL	Col%	'Full Time'	Other	'Full time'		Adjusted	Col%
Male	49,389	100%	61,417	23,740	**68%**		49,389	100%
Female	35,838	73%	56,287	7,742	58%		**40,789**	83%
Differe	13,551	27%	5,130	15,998			8,600	17%
Standardize female income. Use male percentages: **40,789** = **0.68***56,287 + (1-**0.68**)*7,742								
Median incomes: Weighted medians assume Mean/Median is constant for men and women								
Source: Table A7 at https://www.census.gov/library/publications/2021/demo/p60-273.html								

Table 2: Standardized Worker Income by Sex and Work Status

After taking into account work status, female workers now make 83 cents for every dollar a male workers makes: 17% less. Of the original 27 cent gap, 10 cents was due to a difference in the work-status mix. Was the original statement false? No! It was and is a true statement. But it is a half-truth – a prevarication. It leaves out important details.

One example of prevarication is this headline: "Cop shoots unarmed teen". In this case, the policewoman (128 #) shot the 18 year-old male (210#) who was trying to strangle her. Is the headline false? No. Does it leave out very important details? Yes.

You recognize half-truths with words – especially in advertising. But you aren't used to seeing it with numbers. There are no half-truths in arithmetic. But half-truths abound when using everyday statistics obtained from observational studies.

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[2] The use of weighted averages is justified for median incomes assuming the mean-median ratio is the same for all groups. Table A7 at https://www.census.gov/library/publications/2021/demo/p60-273.html

Example #4: Compare COVID death rates: Vaccinated cases are more likely to die than unvaccinated.

Most readers might think this is fake news. If it were true, the drug manufacturers would be sued and nobody would want to get COVID vaccines. Here is the data:

Covid Death Rates Per Case			Death Rates by Age	
	Crude Rate	# Cases	<50	50+
Unvaccinated	**0.17%**	151,052	0.03%	5.96%
Vaccinated	**0.41%**	117,114	0.02%	1.68%
41/17 = 2.4		UK NHS 2021		

Table 3: Crude Comparison of COVID Death Rates by Vaccination Status

Vaccinated cases are 2.4 times as likely to die as unvaccinated cases. This is a moderate effect size. It would take a medium to large confounder to neutralize or reverse this comparison.

On the right side of Table 3, the COVID death rates are broken out by age group. For those under 50, vaccinated cases are more likely to die. For those 50 and up, vaccinated cases re more likely to die.

How can this be? If this were a basketball game and the vaccinated cases won the first half and won the second half (lowest death rates), how could they lose the game? They couldn't. But this isn't a comparison of counts – as in a basketball game. This is a comparison of ratios (death rates).

We need the mixture of the two age groups for the two COVID cases: vaccinated and unvaccinated.

Covid19	------- Number of Cases -------			----- Fraction of Cases -----		
UK NHS 2021	<50	50+	All	<50	50+	All
Unvaccinated	147,612	3,440	151,052	0.977	**0.023**	1.000
Vaccinated	89,807	27,307	117,114	0.767	**0.233**	1.000
All	237,419	30,747	268,166	0.885	0.115	1.000

Table 4: Mixture of cases by Vaccination Status and by Age Group

Look at this difference in mix between the two groups. Vaccinated cases are 10 times as likely to be elderly (50 and up) as [are] unvaccinated cases. The elderly are more likely to have serious medical conditions (co-morbidities). This difference in mix of the elderly can confuse (confound) the observed crude comparison of death rates.

Table 5 shows the crude COVID death rates and the mixture of age groups (decimal fractions).

Covid Death Rates per Case			Crude		Fraction of Cases		
UK NHS 2021	<50	50+	All		<50	50+	All
Unvaccinated	0.03%	5.96%	0.17%		0.977	0.023	1.000
Vaccinated	0.02%	1.68%	**0.41%**		**0.767**	**0.233**	1.000
0.41% = **0.767***0.02% + **0.233***1.68%					0.885	0.115	1.000

Vaccinated cases are 2.4 times (41/17) as likely to die as unvaccinated cases
Table 5: Standardized Death Rates by Vaccination Status

To standardize this crude comparison of rates, we need to give both groups the same mixture of the two age groups. In this case, the combined percentage who are elderly (99.5%) was used for both groups.

Covid Death Rates per Case			Crude	Fraction of Cases			Adjusted
UK NHS 2021	<50	50+	All	<50	50+	All	
Unvaccinated	0.03%	5.96%	0.17%	0.977	0.023	1.000	**0.71%**
Vaccinated	0.02%	1.68%	0.41%	0.767	0.233	1.000	**0.21%**
After taking into account (controlling for) age,				**0.885**	**0.115**	1.000	
unvaccinated cases are 3.4 times as likely				**0.71%** = 0.885*0.03% + **0.115***5.96%			
to die as are the vaccinated cases				**0.21%** = 0.885*0.02% + **0.115***1.68%			

Table 6: Standardized COVID Death Rates by Vaccination Status

The standardized death rate is 71 per 100 for the unvaccinated (21 per 100 for the vaccinated group). Taking into account age reversed the association.

Students have never seen this in 12 years of school math, one year of college Algebra and one year of Calculus. To see this, they would have to take Calculus 3: Differential equations) and study the difference between a total and a partial derivative. Or take Stat 200 (multivariate regression) where they would use computer software to take into account the influence of related factors; confounders.

College graduates who don't realize that taking into account the influence of a confounder can change the size and direction in a comparison of ratios (rates or percentages) is statistically illiterate.

5. Statistical Literacy: UNM Math 1300

Math 1300 (Statistical Literacy) satisfies a general education requirement in mathematics and statistics at the University of New Mexico. This courses doesn't use any computer software and does not involve any algebra. It has less than a 30% overlap with a traditional statistics course.

It does uses margin of error to build confidence intervals. It uses non-overlapping confidence intervals as a sufficient condition for statistical significance. It goes beyond traditional introductory statistics courses by showing how statistical significance can become statistical insignificance (and vice versa) after taking into account a confounder.

Figure 10: Statistical Literacy Course (Math 1300 at the Univ. of New Mexico)

This course is a literacy course. It has a strong emphasis on the use of ordinary English to describe and compare rates and percentages. For example, students learn that "the percentage of women who run" is not the same as "the percentage of women among runners." See the left side of Figure 11.

This course is a math course. Students must be able to work problems that have a number as the answer. They must be able to calculate the results of taking into account the influence of a confounder by standardizing. See the right side of Figure 11.

STATISTICAL LITERACY	
VERBAL SKILLS	**ARITHMETIC SKILLS**
Association-causation grammar	Creating statistical summaries
Arithmetic comparison grammar	Creating arithmetic comparisons
Percent and percentage grammar	Constructing percentage tables
Likely comparison grammar	Constructing half-tables
Crude comparison	Standardizing rates & percentages
Describing & comparing 2x2 data	Constructing 2x2 tables
Confusion of the Inverse	accuracy: confirmation vs. prediction
Diabolical denominator	accuracy: explanation vs prediction
Describing % (#) attributed to	Calculating % (#) attributed to
Margin of error, confidence intervals	Non-overlapping conf. intervals

Figure 11: Statistical Literacy: Verbal and Arithmetic Skills

Finally, this course is a critical thinking course. The goal of the course is to read and interpret everyday statistics used in arguments. How sensitive are these everyday statistics to being influenced? This course has a strong emphasis on hypothetical thinking: thinking about possible ways that things could have been assembled: defined, counted, measured, grouped, compared, and presented.

CRITICAL THINKING
Hypothetical thinking

Alternate definitions	Alternate comparisons
Alternate causes	Alternate explanations
Confounding	Standardization
Error and Bias	Sensitivity of comparison

KEY TAKE-AWAYS

Association is not [necessarily] causation
Disparity is not [necessarily] discrimination
There is a story behind every statistic
A crude comparison is often a half-truth

Figure 12: Statistical Literacy: Critical Thinking and Key Takeaways

Students learn to question everyday statistics. Students see value in this course. (Schield, 2022c)

- A third of those taking this course at the University of New Mexico agreed or strongly agreed that this course should be required by all students for graduation.
- Half of those taking this course thought it did more to help their critical thinking than any other course that had ever taken.

Conclusion

Humanities faculty should require that any college-wide quantitative literacy requirement should teach students(1) How to use ordinary English to distinguish association from causation, to describe and compare rates and percentages and to use critical thinking in thinking hypothetically about how statistics are assembled: how they are defined, counted measured, grouped and presented. (2) What it means to take something into account quantitatively. (3) How to read tables and graphs of percentages and rates. (4) How to read and interpret the sensitivity of everyday statistics to be influenced.

Humanities faculty should encourage their colleagues in mathematics and statistics to offer a confounder-based, non-Algebra based Statistical Literacy course for students in non-quantitative majors as an alternative to the traditional statistical inference course with its primary focus on randomness.

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Literary Landscapes: Forms of knowledge in the Humanities.

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PROPOSAL:

Title: *Statistical Literacy: Humanistic Education for the Future*

Subtitle: *Quantitative Rhetoric for the Humanities*

Abstract: The qualitative/conceptual reasoning used in the humanities is being pushed aside by the quantitative/observable reasoning used in the social sciences. Statistical comparisons seem as immutable as basic arithmetic. But social statistics are numbers in context. Most social statistics are subject to context in the same way that ideas involving the human condition are. For example, the UK National Health Service found that among COVID cases, the vaccinated were more likely to die than the unvaccinated. But after taking into account age, the comparison reversed: the unvaccinated were more likely to die. Statistical literacy teaches students to focus on what was – and was not – taken into account. Statistical Literacy is critical thinking about everyday statistics as evidence in arguments: how statistics are constructed and manipulated. Students are taught how to think hypothetically about how things may have been defined, counted, measured, compared and presented. Statistical literacy doesn't require computer software; it uses ordinary English to distinguish association from causation and to describe and compare conditional probabilities. Instead of Algebra, it uses basic arithmetic and weighted averages. It has less than a 30% overlap with traditional introductory statistics. Half of those taking statistical literacy said it did more to develop their critical thinking than any other course they had taken. This paper summarizes the highlights of Statistical Literacy (Math1300) as a mathematics course satisfying a general education requirement at the University of New Mexico. Educators in the humanities are encouraged to promote the adoption of Statistical Literacy for their students.   [248/251 words]

Knowledge focus: *Interpretative Research*
Presentation Theme: *Past and Present in Humanistic Education*

Keywords: Critical thinking, Humanistic education, Context, Quantitative rhetoric

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Paper presented online.

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V2: Removed duplicate image in figure 2. Respaced to fit paging. Added video link.