

THE FINAL TALK

# Part 1

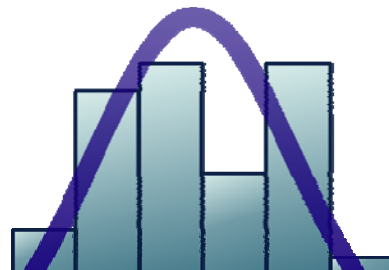
STATISTICS, PIRATES, MARIJUANA, AND BEST PRACTICES  
IN EDUCATION FROM 2000 YEARS AGO

OR

HOW I HATE CORRELATION STUDIES WITH EVERY FIBER  
OF MY BEING

OR

ALTERNATIVES TO USING STATISTICS  
FOR DECISION MAKING



First Rule of Statistics Club:

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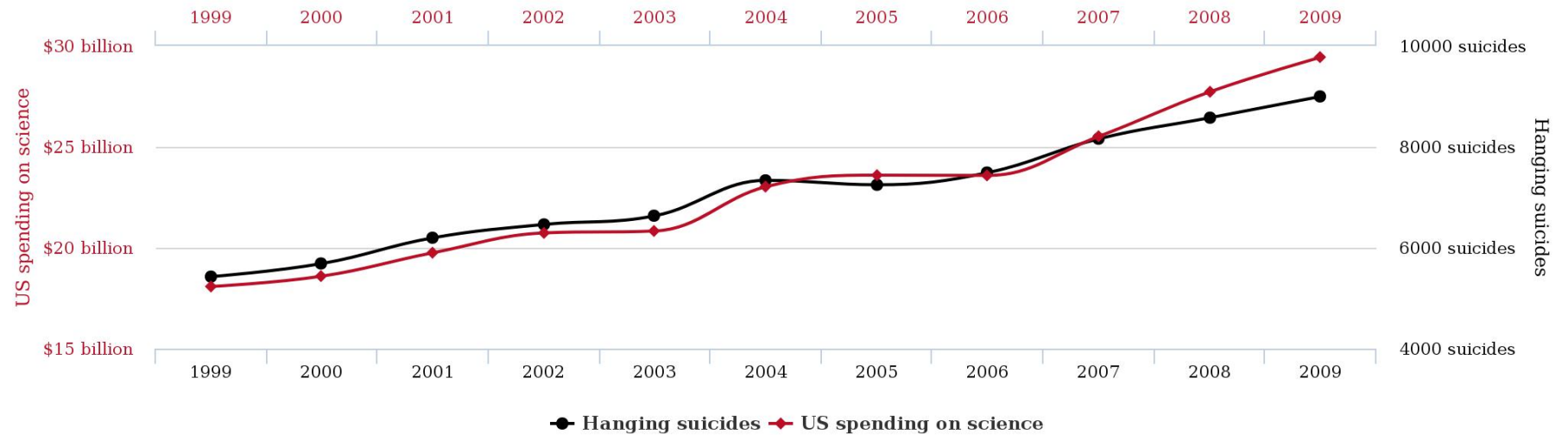
Correlation does not imply causality

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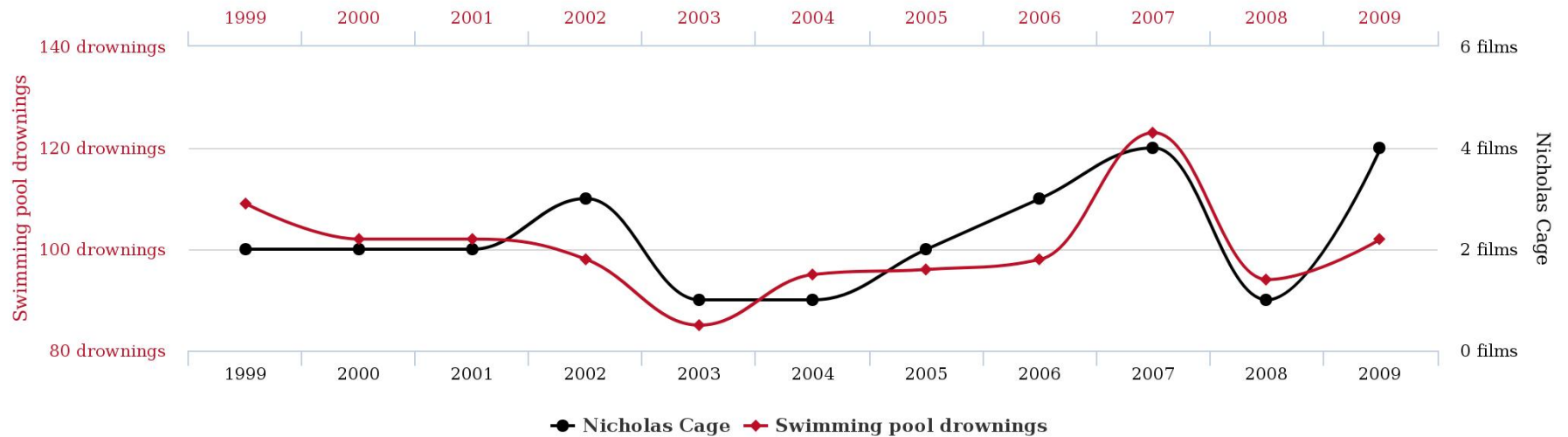
Correlation does not imply causality

For example,

**US spending on science, space, and technology**  
correlates with  
**Suicides by hanging, strangulation and suffocation**

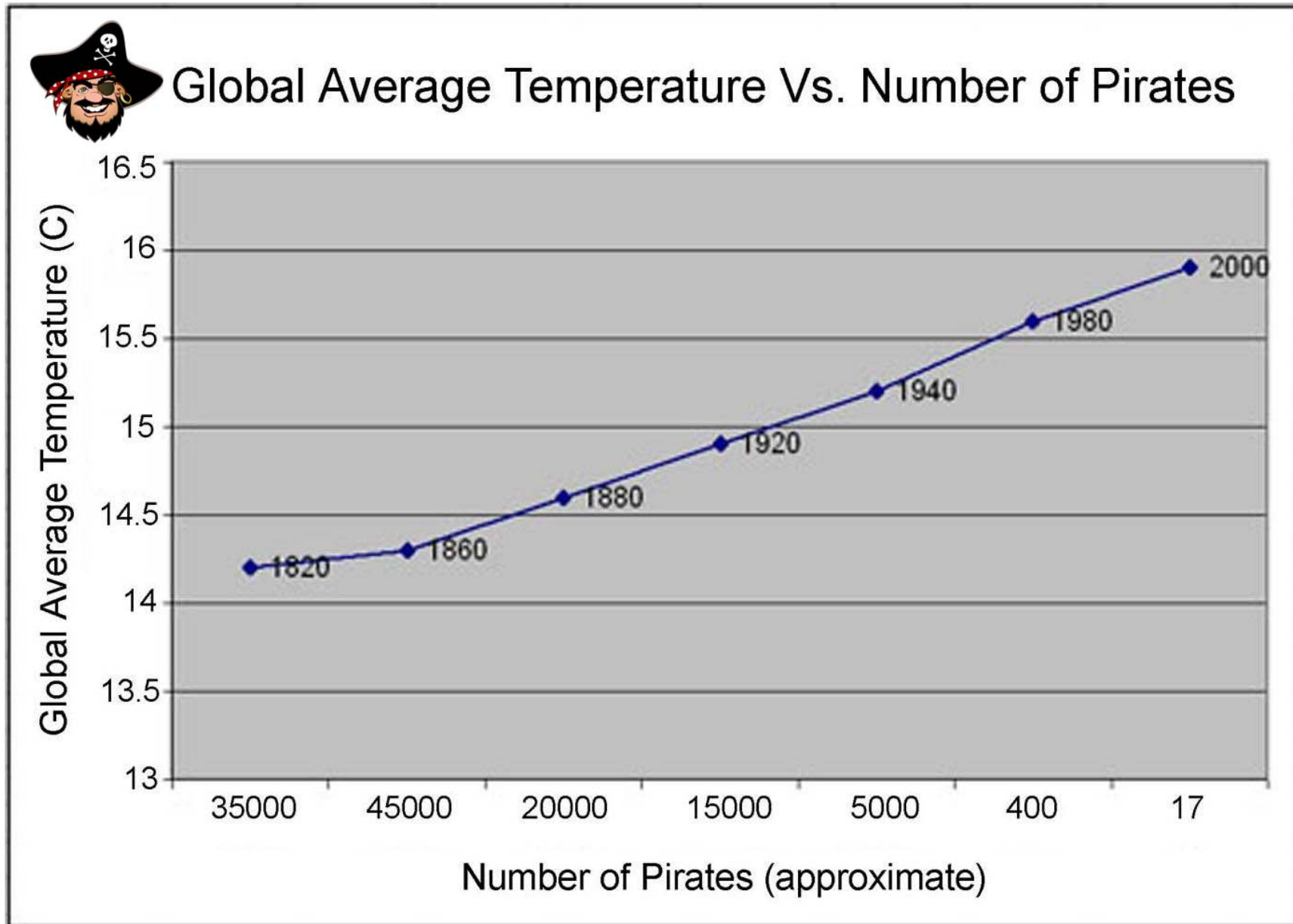


**Number of people who drowned by falling into a pool**  
correlates with  
**Films Nicolas Cage appeared in**





# STOP GLOBAL WARMING: BECOME A PIRATE



But on the other hand,



# Does marijuana use cause a decrease in IQ?

**Table 1. IQ before and after cannabis use**

	<i>N</i>	% male	Age 7–13 full-scale IQ	Age 38 full-scale IQ	$\Delta$ IQ effect size*
<b>Persistence of cannabis dependence</b>					
Never used, never diagnosed	242	38.84	99.84 (14.39)	100.64 (15.25)	0.05
Used, never diagnosed	479	49.48	102.32 (13.34)	101.25 (14.70)	–0.07
1 diagnosis	80	70.00	96.40 (14.31)	94.78 (14.54)	–0.11
2 diagnoses	35	62.86	102.14 (17.08)	99.67 (16.11)	–0.17
3+ diagnoses	38	81.58	99.68 (13.53)	93.93 (13.32)	–0.38
<b>Persistence of regular cannabis use</b>					
Never used	242	38.84	99.84 (14.39)	100.64 (15.25)	0.05
Used, never regularly	508	50.59	102.27 (13.59)	101.24 (14.81)	–0.07
Used regularly at 1 wave	47	72.34	101.42 (14.41)	98.45 (14.89)	–0.20
Used regularly at 2 waves	36	63.89	95.28 (10.74)	93.26 (11.44)	–0.13
Used regularly at 3+ waves	41	78.05	96.00 (16.06)	90.77 (13.88)	–0.35

A 2012 study by Madeline Meier that used longitudinal data from New Zealand found a correlation between the amount of marijuana used and the amount of decrease in IQ over time.



However, does this mean that marijuana  
causes a decline in IQ?



Here are the results of a variety of studies:



HARVARD – No difference in IQ between the marijuana group and the non-marijuana group after 28 days of abstinence.

NEW ZEALAND – Loss in IQ over time is dependent on dose. Significant loss of an average of 8 points by age 38 for people who start smoking heavily as teenagers. No significant loss for people who start as adults.

CANADA – Decrease in IQ of 4.1 points among heavy users. Increase by 5.8 points among light users.

UNITED KINGDOM – Loss in IQ can be explained by confounding variables such as tobacco use, alcohol use, and other drug use.

There are lots of problems I've found in the analysis of Madeline Meire's New Zealand study, but I'll focus primarily on the main result of the correlation analysis and the ways in which correlation studies get used and abused in the real world.



Problem 1: When there is a correlation between variables, the media will often say they are “linked.” This does not mean there is a causal relationship.

### Marijuana Linked to Low IQ in Teenagers, Study Says

*Published August 28, 2012 / Fox News Latino*



Problem 2: Cherry picking data. For example, the NIDA often quotes the New Zealand study, but not others.

**National Institute  
on Drug Abuse**  
*The Science of Drug Abuse & Addiction*

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Early-Onset, Regular Cannabis Use Is Linked to IQ Decline  [Print](#)  [Share](#)

**NIDA**Notes

August 13, 2013  
*Kathryn Calkins, M.A., NIDA Notes Staff Writer*

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Regular cannabis use that starts in adolescence strips away IQ, a NIDA-supported 25-year study of 1,000 individuals suggests. Study participants who initiated weekly cannabis use before



**NIDA**Notes **Dr. Madeline Meier**  
Researcher, Duke University

In this [video](#), Dr. Madeline Meier discusses her study of marijuana and IQ.

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Problem 3: What starts as a correlation often gets reported later as causality.

## Drop in Intelligence

A major study proves marijuana is harmful to the developing brain. Early, long-term use found to lower IQ by 7-8 points.  
(NIDA)



FEB 10, 2015 @ 10:20 AM    96,914 VIEWS

# Study Shows Heavy Adolescent Pot Use Permanently Lowers IQ



**Travis Bradberry**, CONTRIBUTOR

*I cover emotional intelligence and leadership performance.*

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Opinions expressed by Forbes Contributors are their own.

**FULL BIO** ▾

Marijuana smokers have long been characterized as dimwitted and slow. They tend to shrug off these stereotypes as artifacts of how they are when they're on the drug. If you've ever had the misfortune of enduring a pot smoker who takes you through the "beneficial" effects of marijuana on the brain, then you've likely wondered if the stereotype is true. As it turns out, it is.

Problem 4: The linear regression t-test is the most misused test in all of statistics.



In the New Zealand study, Meier shows that the correlation between marijuana use and IQ is significantly different from zero.

**Table 2. IQ subtest changes**

IQ test/subtest	Never used, never diagnosed, <i>n</i> = 242	Used, never diagnosed, <i>n</i> = 479	1 diagnosis, <i>n</i> = 80	2 diagnoses, <i>n</i> = 35	3+ diagnoses, <i>n</i> = 38	Linear trend t test*	<i>P</i>
Full-scale IQ	0.05	−0.07	−0.11	−0.17	−0.38	−4.45	<0.0001
Verbal IQ	0.02	−0.05	−0.13	−0.19	−0.31	−4.15	<0.0001
Information subtest	0.05	−0.08	0.02	−0.25	−0.15	−2.40	0.0168
Similarities subtest	0.03	−0.05	−0.03	−0.19	−0.44	−2.78	0.0056
Vocabulary subtest	0.07	−0.05	−0.16	−0.16	−0.45	−3.67	0.0003
Arithmetic subtest	−0.05	−0.07	−0.05	0.00	0.06	−0.73	0.47
Performance IQ	0.08	−0.08	−0.09	−0.08	−0.42	−2.84	0.0046
Digit symbol coding subtest	0.15	−0.09	−0.17	−0.23	−0.62	−5.60	<0.0001
Block design subtest	−0.03	−0.07	−0.01	−0.11	0.02	−0.55	0.58
Picture completion subtest	−0.01	−0.08	0.08	0.05	0.15	1.18	0.24



## Problem 5: The lead person on a study is often not a statistician themselves.

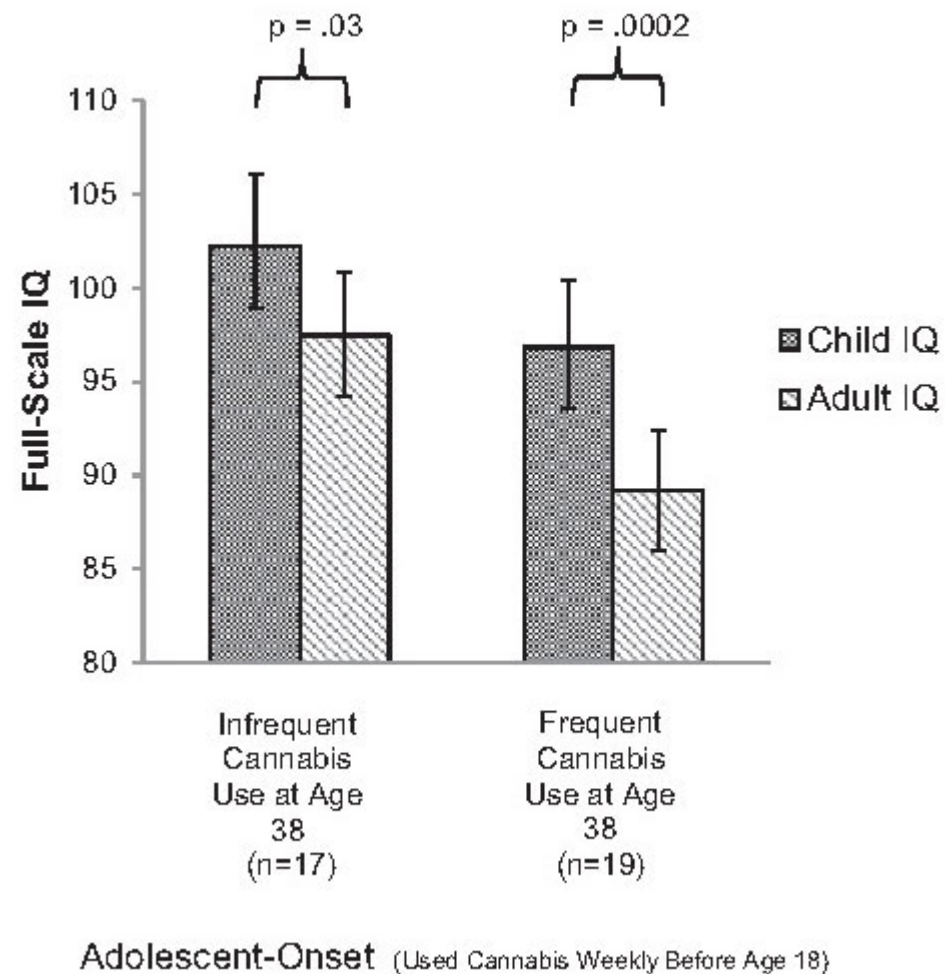


"Your doctor will be here in a minute, I'm a placebo."



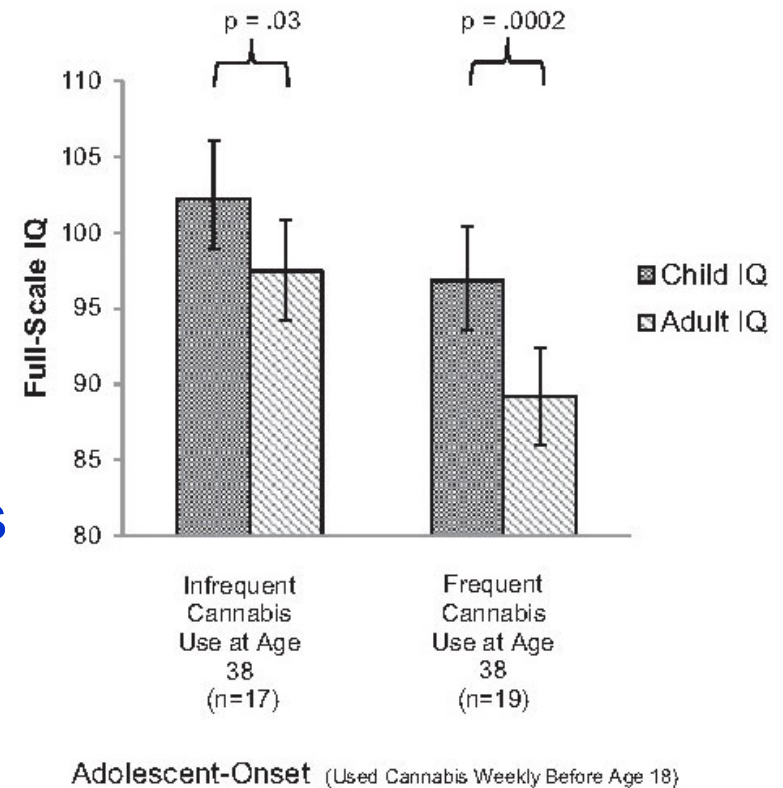
"Sorry, we don't serve raw data - how would you like us to cook the numbers?"

## Problem 6: What's wrong with this picture?





- The vertical axis scale begins at 80.
- The means are not explicitly stated.
- The paper doesn't state what statistical test was performed.
- T-values, standard deviations, and other summary statistics are not reported.
- The sample sizes are very small.
- People with mental illness and users of tobacco, alcohol, and hard drugs haven't been removed from the samples.
- We don't know if 28 days has elapsed between their last use of cannabis and the IQ test.



## Remember:

- Correlation does not imply causality.
- Other studies have found that the drop in IQ is due to confounding variables.
- Meier fails to report the correlation between dose and IQ in her study.
- The linear correlation in her study is  $r = -0.15$ . This is a very weak correlation.
- Only 2.25% of the variation in IQ can be explained by marijuana use. That's not much. Plus, sample size (874) is a confounding variable. What explains the other 97.75%?

So, while there are many reasons why teen use of marijuana is often a bad idea, does it really cause a permanent drop in IQ?



Probably not according to a recent twin study that found that compared the IQ of the smoking twin with that of the non-smoking twin.



Study of teenage twins finds little evidence that using marijuana lowers IQ.

Stanimir G. Stoev/Shutterstock

## Twins study finds no evidence that marijuana lowers IQ in teens

By **Emily Underwood** | Jan. 18, 2016, 3:00 PM

So, we've seen that statistics can be subtle, correlation studies can be misleading, and people will often misuse statistics through ignorance or for their own political ends.



So what are the alternatives?





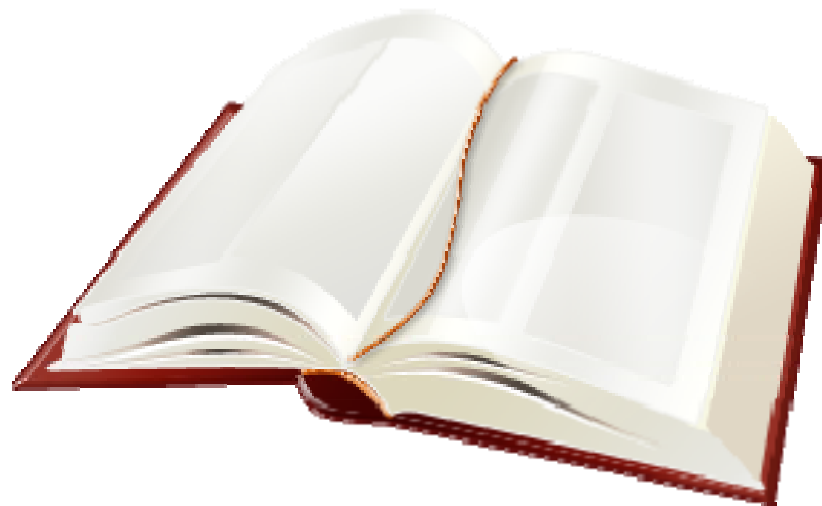
Sometimes the best alternative is the collective experience of lots of people.



# Part 2



# BEST PRACTICES IN EDUCATION – 2000 YEARS AGO!



***“The world exists only by virtue of the breath coming from the mouths of school children engaged in their studies.”  
(B. Shabbat 119b)***

# *LESSONS FOR STUDENTS*



## 1. Study with a buddy

*“Rabbi Hama ben Hanina said, ‘What is the meaning of the saying, “Iron sharpens iron? (Proverbs 27:17)” This is to teach you that just as in the case of one iron implement sharpening another, so also do two students sharpen each other’s mind.’” (B. Ta’anith 7a)*

## 2. Set aside fixed times for study

*“That brings forth its fruit in its season and whose leaf doth not wither (Psalm 1:3)’ — was explained by Raba as follows, ‘If he brings forth his fruit in its season (studies at fixed times), then his leaf will not wither (he will remember what he has learned).’”  
(B. Avodah Zarah 19b)*

### 3. Don't cram; learn a little each day

*“Raba expounded in the name of Rabbi Sehora who had it from Rav Huna, ‘What is the meaning of the text, “Wealth gotten by vanity shall be diminished, but he that gathers little by little shall increase (Proverbs 13:11)?” If a man studies much at a time his learning decreases, but if he does not do so but instead “gathers little by little” his learning shall increase.’” (B. Eirubin 54b)*

## 4. Don't skip class

*“Rav Judah said in Rav's name, ‘One should never abstain from attendance at the House of Study even for a single hour, for lo, how many years was a particular passage taught in the House of Study without its reason being revealed, until Rabbi Hanina ben Akiba came and elucidated it?’” (B. Shabbat 83b)*

## 5. Listen when your teacher is speaking

*“When scholars disseminate the Torah, you should modestly stay in the background so as not to compete with them.”  
(B. Berachoth 63a)*



## 6. Engage in repetition and review of your lessons

*“He that repeats his studies a hundred times is not to be compared with him who repeats his studies a hundred and one times.” (B. Chagiagah 9b)*

*“If you will listen to the old, you will be able to listen to the new, but “if your heart turns away (Deuteronomy 30:17),” you will no more listen .” (B. Sukkah 49b)*

*“Ben Bag Bag said, ‘Turn it over and over again.’”  
(Pirkei Avot 5:22)*

## 7. Study even if you don't fully understand

*“A man should study even if he doesn't fully understand, and understanding will come later.” (B. Shabbat 63a)*

*“This, too, did Raba say, ‘Let one by all means learn, even though he is liable to forget, yea, even if he does not fully understand all the words which he studies. As it is said, “My soul breaks for the longing that it has for Your ordinances at all times. (Psalm 119:20)”’”  
(B. Avodah Zarah 19a)*

**נעשה ונשמע (Exodus 24:7)**

“We will do, and we will understand.”

## 8. Use mnemonics when necessary

*“Rabbi Hisda stated, ‘The Torah can only be acquired with the aid of mnemonic signs, for it is said, “Put it in their mouths.”’ (‘Now therefore write this poem for you, and teach it to the people of Israel. Put it in their mouths, that this poem may be a witness for me against the people of Israel (Deuteronomy 31:19).’)” (B. Eirubin 54b)*

## 9. Involve your whole being in the learning process

*“Beruriah once discovered a student who was learning in an undertone (a subdued utterance). Rebuking him she exclaimed, Is it not written, “Ordered in all things and sure? (II Samuel 23:5)” If it is “ordered” in your two hundred and forty-eight limbs, it will be “sure.” Otherwise it will not be sure.” (B. Eirubin 54a)*

## 10. Learn from your teachers even if they are not perfect

*“When asked how he could learn Torah from a heretic such as Acher, Rabbi Meir replied that when he finds a juicy pomegranate he eats the fruit and throws away the peel.”  
(B. Chagigah 15b)*

## 11. To master a subject, first learn the basics from one teacher, and then learn from several teachers

*“And he shall be like a tree transplanted by streams of water (Psalm 1:3)’ — Those of the school of Rabbi Jannai said ‘a tree transplanted,’ not ‘a tree planted,’ which implies that whoever learns Torah from one master only will never achieve great success. Said Rabbi Hisda to the rabbinic students, ‘I have a mind to tell you something, though I fear that you might leave me and go elsewhere. Whoever learns Torah from one master only will never achieve great success.’ They did leave him and went to sit before Rabbah, who, however, explained to them that the maxim only applies to lessons in logical deductions. But as to oral traditions, it is better to learn from one master only so that one is not confused by the variations in the terms used.” (B. Avodah Zarah 19a-19b)*

## 12. Respect your peers and teachers

*“Rabbi Eleazar ben Shammua said, ‘Let the honor of your student be as dear to you as your own, and the honor of your colleague as the reverence you have for your teacher, and the reverence for your teacher as your awe of Heaven.’”  
(Pirkei Avot 4:12)*

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*“Rabbi Johanan said, ‘You are sneering at the words of the Sages!’ Rabbi Johanan then set his eyes on him and the student turned into a heap of bones.” (B. Baba Bathra 75a)*



### 13. Study what you have a passion for

*“A man can learn well only that part of the Torah which is his heart's desire, for it is said, ‘But whose delight is in the law of the Lord (Psalm 1:2).’” (B. Avodah Zarah 19a)*

## 14. Old scholars still deserve respect

*“Which thou didst break, and thou shalt put them in the ark.’ Rabbi Joseph said, ‘This teaches us that both the second set of tablets and the fragments of the original tablets were deposited in the ark. Hence we learn that a scholar who has forgotten his learning through no fault of his must not be treated with disrespect.’”  
(B. Menachoth 99a)*

## 15. Take good care of your brain

*“When wine goes in, secrets come out.” (B. Sanhedrin 38a)*

*“Intelligence imparts fragrance and relish to a man's words. When the wine goes in intelligence takes its leave. Wherever there is wine, there is no intelligence.” (Numbers Rabbah X:8)*

# ***LESSONS FOR TEACHERS***



## 1. Those who can, teach

*“Rabbi Johanan further said, ‘One who studies but does not teach it is like a flower in the desert whose fragrance is wasted.’” (B. Rosh HaShanah 23a)*

## 2. We learn from our students

*“Rabbi Hanina said, ‘I have learned much from my teachers, more from my colleagues, but from my students I have learned the most of all.’” (B. Ta'anith 7a)*

### **3. There are boundaries that must be respected by both students and teachers**

*“It was taught, ‘A disciple must not take a bath with his teacher, but if his teacher needs him, it is permitted.’” (B. Pesachim 51a)*

#### **4. Use good students to help poor students**

*“The attentive one will read on his own, and if one is inattentive, put him next to a diligent one.” (B. Baba Bartha 21a)*



## 5. Act and dress appropriately

*“Rabbi Hiyya ben Abba said in Rabbi Johanan's name, ‘It is a disgrace for a scholar to go out with patched shoes into the market place.’” (B. Shabbat 114a)*

*“Rabbi Hiyya ben Abba also said in Rabbi Johanan's name, ‘Any scholar upon whose garment a grease stain is found is worthy of death.’” (B. Shabbat 114a)*

## 6. Don't embarrass your students (or anyone!) in public

*“A tanna recited before Rabbi Nahman ben Isaac, ‘He who publicly shames his neighbor is as though he shed blood,’ whereupon he remarked to him, ‘You say well, because I have seen such shaming, the ruddiness departing and paleness supervening.’”  
(B. Baba Metzia 58b)*

## 7. There's an optimum class size

*“Raba further said, ‘The number of pupils to be assigned to each teacher is twenty-five. If there are fifty, we appoint two teachers. If there are forty, we appoint an assistant at the expense of the town.’” (B. Baba Bartha 21a)*

## 8. Challenge your students

*“It was taught that Rabbi Akiba said, 'It was not Rabbi Ishmael who laid down this ruling but that disciple, and the halachah (law) is in agreement with that disciple.' Is not this self-contradictory? You first said, 'It was not Rabbi Ishmael who laid down this ruling,' from which it is obvious that the law is not in agreement with his view, and then you say, 'The law is in agreement with that disciple which implies that it is also in agreement with his teacher, Rabbi Ishmael.' Rab Judah replied in the name of Samuel, ‘Rabbi Akiba made that statement for the sole purpose of exercising the wits of the students.’”*  
(B. Eirubin 13a)

## 9. Don't water down your subject matter

*“Rav Judah said in Rav's name, ‘Whoever fails to teach a point of law to his student is as though he had robbed him of his ancestral heritage, as it is written, “Moses commanded us a law, even the inheritance of the congregation of Jacob (Deuteronomy 33:4).” It is an inheritance destined for all Israel.’” (B. Sanhedrin 91a)*

## 10. There are different types of students

*“There are four types of character among those who sit before the sages. They are typified by a sponge, a funnel, a strainer, and a sieve. A sponge absorbs all, a funnel lets in at one end and lets out at the other, a strainer lets out the wine but retains the sediment, and a sieve lets out the coarse meal but retains the choice flour.” (Pirkei Avot 5:15)*

## 11. Restrain yourself when disciplining students

*“When you wish to punish a student, hit him with nothing harder than a shoelace.” (B. Baba Bartha 21a)*

## 12. Respect your colleagues

*“Rabbi Jeremiah said in the name of Rabbi Simeon ben Lakish, ‘When two scholars are amiable to each other in their discussions in halachah (law), the Holy One, blessed be He, gives heed to them.’” (B. Shabbat 63a)*



### 13. College still isn't for everyone

*“If a student does not see a sign of blessing (i.e. progress) in his studies after five years, he never will.” (B. Chullin 24a )*

## 14. Be a fountain of knowledge

*“Rabbi Tanhuma said, ‘Just as the spice-maker's chest (migdaloth) is full of all manner of spices, so a scholar should be full of Scripture, Mishnah, Talmud, halachoth (law) and haggadoth (parables).’”  
(Song of Songs Rabbah V:18)*

## 15. We forget so that we can engage in lifelong learning

*“Rabbi Isaac said, ‘It is for man’s good that he learns Torah and forgets it, because if a man studied Torah and never forgot it, he would occupy himself with learning it for two or three years and then resume his ordinary work and never pay further attention to it. But since a man studies Torah and forgets it, he will not entirely abandon its study.’” (Ecclesiastes Rabbah I:32)*



*The End*

