Psychology 205: Research Methods in Psychology
Field studies and randomized designs
The example of epidemiology and honors workshops

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November, 2016

Outline

Epidemiology

Observational studies

Randomized field trials

A field trial in STEM

References

Design problems in developmental psychology

1. A developmental psychologist believed that happiness increases with age among married couples. She collected data from two sets of married couples: couples who were 40-50 years old and had been married for at least 15 years and couples who were 50-65 years old and had been married for at least 25 years. All couples has been married only once. She found that the older couples reported more positive affect and less negative affect than did the younger couples. She concluded from this that age does indeed lead to happiness.
2. There is a serious artifact in this study that makes the conclusions questionable. What is it?
3. Can you think of a way to get around this problem?

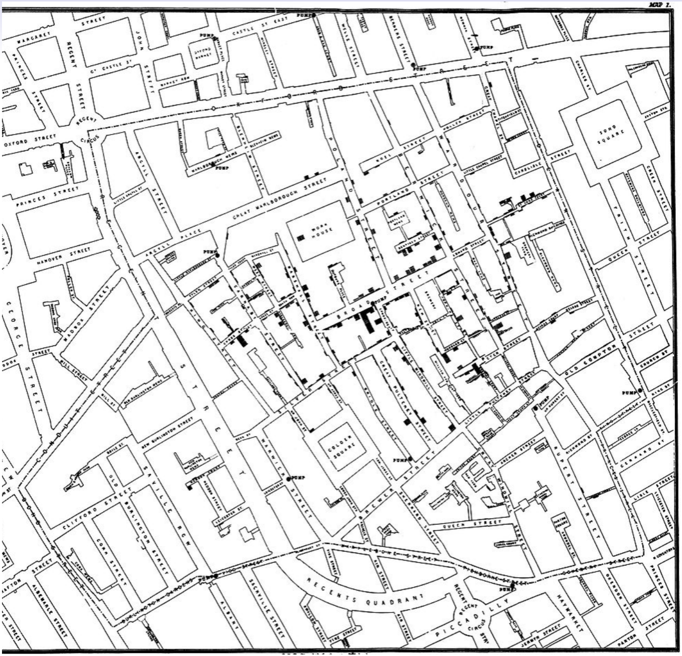
The benefits and problems of field studies

1. Two recent studies of the effect of diet on longevity have shown that:
   - People who have low fat diet live longer (Study 1)
   - But there is no effect of a low fat diet on your health (Study 2).
2. Both studies were very well powered (many participants) and carefully done.
3. How can this be?

Epidemiology

Classic case of John Snow and tests of the "Miasma" hypothesis

1. Cholera epidemics would hit London in the summer.
2. Particularly a problem on the South side of the river where the air was very bad.
3. The hypothesis was that cholera was spread by "miasma" or bad air.
4. "On 31 August 1854, after several other outbreaks had occurred elsewhere in the city, a major outbreak of cholera reached Soho. John Snow, the physician who eventually linked the outbreak to contaminated water, later called it "the most terrible outbreak of cholera which ever occurred in this kingdom."[2]
   Over the next three days, 127 people on or near Broad Street died. In the next week, three quarters of the residents had fled the area. By 10 September, 500 people had died and the mortality rate was 12.8 percent in some parts of the city. By the end of the outbreak, 616 people had died." (Wikipedia)


MAP I.
OXFORD STREET
SOHO SQUARE
WORK HOUSE
GOLDEN SQUARE
BROAD STREET
GREAT MARLBOROUGH STREET
HANOVER STREET
PRINCES STREET
QUEEN STREET
REGENTS QUADRANT
PICCADILLY
PUMP

Snow and the Broadstreet pump

1. On proceeding to the spot, I found that nearly all the deaths had taken place within a short distance of the [Broad Street] pump. There were only ten deaths in houses situated decidedly nearer to another street-pump. In five of these cases the families of the deceased persons informed me that they always sent to the pump in Broad Street, as they preferred the water to that of the pumps which were nearer. In three other cases, the deceased were children who went to school near the pump in Broad Street...
2. With regard to the deaths occurring in the locality belonging to the pump, there were 61 instances in which I was informed that the deceased persons used to drink the pump water from Broad Street, either constantly or occasionally...
3. The result of the inquiry, then, is, that there has been no particular outbreak or prevalence of cholera in this part of London except among the persons who were in the habit of drinking the water of the above-mentioned pump well.

Epidemiology

1. The branch of medicine that deals with the incidence, distribution, and possible control of diseases and other factors relating to health.
2. Typical study is correlational: Higher levels of variable X are associated with more of disease Y
3. Adapted from Gary Taubes: 'Do we really know what makes us healthy'. New York Times Magazine, September 16, 2007. http://www.nytimes.com/2007/09/16/magazine/16epidemiology-t.html?_r=2&ref=magazine&pagewanted=all&oref=slogin&oref=slogin

Hormone Replacement Therapy

1. Nurses study (observational)
   - HRT is good
2. Women's Health Initiative (random assignment)
   - HRT is slightly bad

Nurses Health Study

1. Observational study of nurses
2. Positive effect of estrogen on heart disease
3. but also observed reduction in death by homicide, suicide, and accidents

The bias of healthy users

1. People who faithfully engage in activities that are good for them – taking a drug as prescribed, ... or eating what they believe is a healthy diet – are fundamentally different from those who don't.
2. Nurses who took HRT were thinner, fewer risk factors for heart disease, more educated, wealthier, exercise more, more health conscious.

www.nytimes.com/2007/09/16/magazine/16epidemiology-t.html?_r=2&ref=magazine&pagewanted=all&oref=slogin&oref=slogin

The bias of compliance

1. People who comply with their doctors' orders are healthier than those who don't
2. Effects are even true for placebo takers!

Doctors' prescribing effect

1. People who are eager to take particular drugs are probably different than those who are not

Randomized field trials as an alternative

1. Observational studies have all kinds of biases, what about doing random assignment?
2. How to do it?
3. The example of the Women's Health Initiative

Women's Health Initiative

1. Older (pre and post menopausal) women
2. Randomized field trial
3. HRT vs placebo
4. Reduced fat versus normal
5. Calcium supplements versus placebo

Participation bias

1. Who participates in a random study?
2. Who complies with instructions?
3. Effect of assignment versus effect of actual treatment
4. Must do the analysis on all subjects

WHI results

1. Stopped HRT trials after slightly greater risk of heart attack
2. Effect of dietary modification was minimal unless one looked just at the compliant subjects (but see above)

The crises in science education

1. STEM majors are decreasing
   - Science, Technology, Engineering, Math
2. Particularly, women and minorities are not enrolling in or not continuing in STEM courses
3. Why is this happening?

Alternative explanations for STEM differences

1. Ability
2. Interests
3. Discrimination
4. Stereotype threat

Honors Workshops in STEM courses

1. Evidence from calculus classes that study groups help performance
2. Treisman (1992) at UCB found that white and asian males used study groups, females and african-american students did not
3. Interpreted differences in test performance as motivational effect

Study group effect on motivation

1. Student by him/her self
   - I don't know how to do problem 6
   - I must be stupid
2. Student in study group
   - I know how to do problem 5,
   - you know how to do problem 6,
   - let's teach each other
   - I am not stupid, the material is hard!

Biology Honors workshops at NU

1. Students asked if interested in participating
   - volunteers more interested in biology
   - volunteers more anxious
2. Among those willing to participate, random assignment to honors study groups or not
3. Workshop students did better, more likely to complete the course than those who volunteered but did not participate

Born, W. K., Revelle, W., & Pinto, L. (2002) Improving Biology Performance with Workshop Groups. Journal of Science Education and Technology. 11, 347-365.

1. This 2-year quasi-experiment evaluated the effect of peer-led workshop groups on performance of minority and majority undergraduate biology students. The workshop intervention used was modeled after a program pioneered by Treisman (1992).
2. Majority volunteers randomly assigned to workshops (n = 61) performed signicantly better than those assigned to the control group ($n = 60, p < 0.05$) without spending more time studying.
3. Workshop minority students (n = 25) showed a pattern of increasing exam performance in comparison to historic control minority students (n = 21), who showed a decreasing pattern ($p < 0.05$).

Born et al. (continued)

1. Volunteers (n = 121) initially reported that biology was more interesting and more important to their futures than did nonvolunteers ($n = 435, p < 0.05$).
2. Volunteers also reported higher levels of anxiety related to class performance ($p < 0.05$).
3. The relationship of anxiety to performance was moderated by volunteer status.
4. Performance of volunteers was negatively associated with self-reported anxiety ($r =?0.41, p < 0.01$).
5. Performance of nonvolunteers was unrelated to self-reported anxiety ($r = -0.02$).

Born et al. (continued)

1. Results suggest elevated anxiety related to class performance may increase willingness to participate in activities such as workshop interventions.
2. In addition, students who volunteer for interventions such as workshops may be at increased risk of performance decrements associated with anxiety.
3. Even so, workshop programs appear to be an effective way to promote excellence among both majority and minority students who volunteer to participate, despite the increased risk of underperformance associated with higher levels of anxiety.

Born et al. results

Table II. Survey Measures of Motivation for Nonvolunteer, Control, Workshop Majority, and Workshop Minority Students

				Volunteers								
	Nonvolunteers (Majority)			Control (majority)			Workshop majority			Workshop minority		
Ability	*M*	SD	*n*	*M*	SD	*n*	*M*	SD	*n*	*M*	SD	*n*
Survey 1												
Anxiety[a]	0.00	1.00	131	0.46	0.93	17	0.27	0.96	35	0.60	0.97	14
Interest[a]	0.00	1.00	135	0.33	0.79	16	0.53	1.10	35	0.28	0.85	14
Importance[b]	0.00	1.00	133	0.13	0.57	16	0.40	0.58	36	0.42	0.53	14
Liking	0.00	1.00	133	−0.24	1.07	16	0.00	1.15	36	−0.17	1.23	14
Study hours	0.00	1.00	133	0.00	1.37	17	−0.13	0.76	36	0.57	1.67	14
Survey 2												
Interest	−0.32	1.20	106	−0.87	1.37	14	−0.04	1.07	30	−0.32	1.11	13
Importance	−0.05	0.98	106	−0.01	1.24	14	−0.03	1.17	30	0.00	1.01	13
Liking[c]	−0.50	0.97	106	−0.75	1.05	14	−0.18	0.82	30	−0.72	1.21	13
Study hours[d]	−0.72	0.85	106	0.39	2.66	14	−0.29	1.03	30	−0.26	0.85	13

[a] At Survey 1 nonvolunteers differ from volunteers (control + workshop majority); $p < 0.01$.
[b] At Survey 1 nonvolunteers differ from volunteers (control + workshop majority); $p < 0.05$.
[c] From Survey 1 to Survey 2 nonvolunteers show a steeper decline than volunteers (control + workshop majority); $p < 0.05$.
[d] From Survey 1 to Survey 2 nonvolunteers show a steeper decline than volunteers (control + workshop majority); $p < 0.01$.

Born et al. results

Change over time

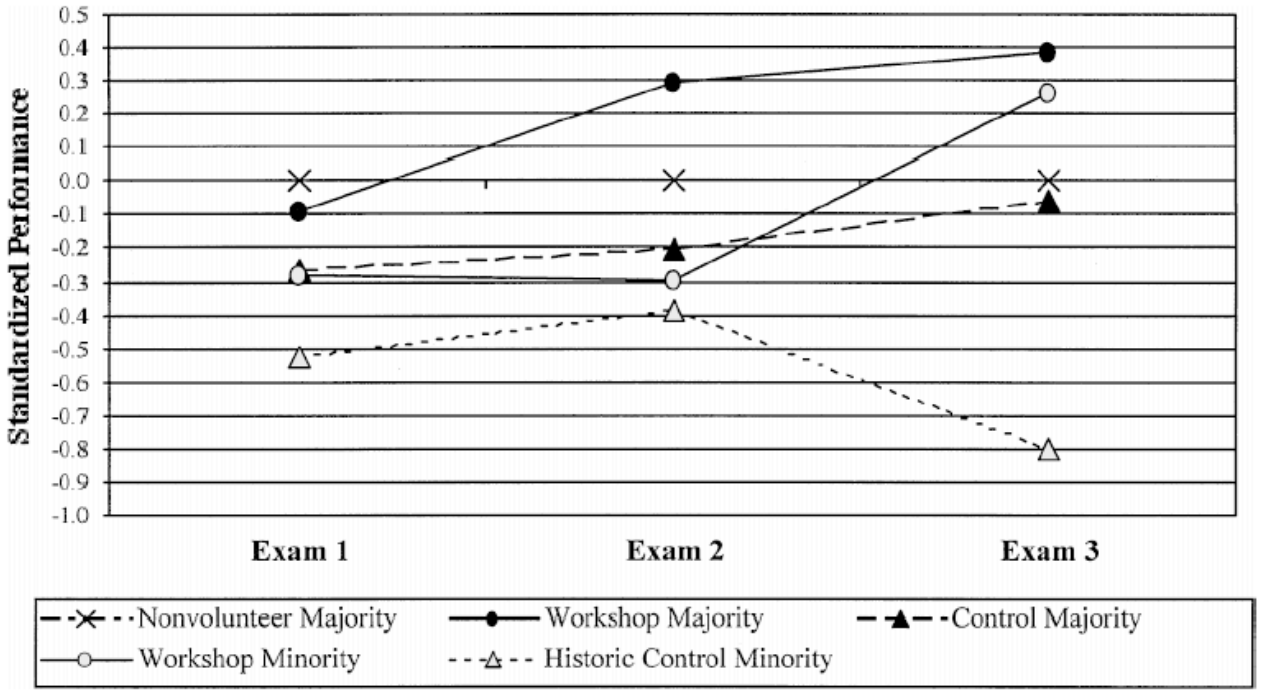


Fig. 1. Standardized Quarter 1 exam performance as a function of group, controlling for prior cumulative grade point average.

Born et al. results controlling for GPA

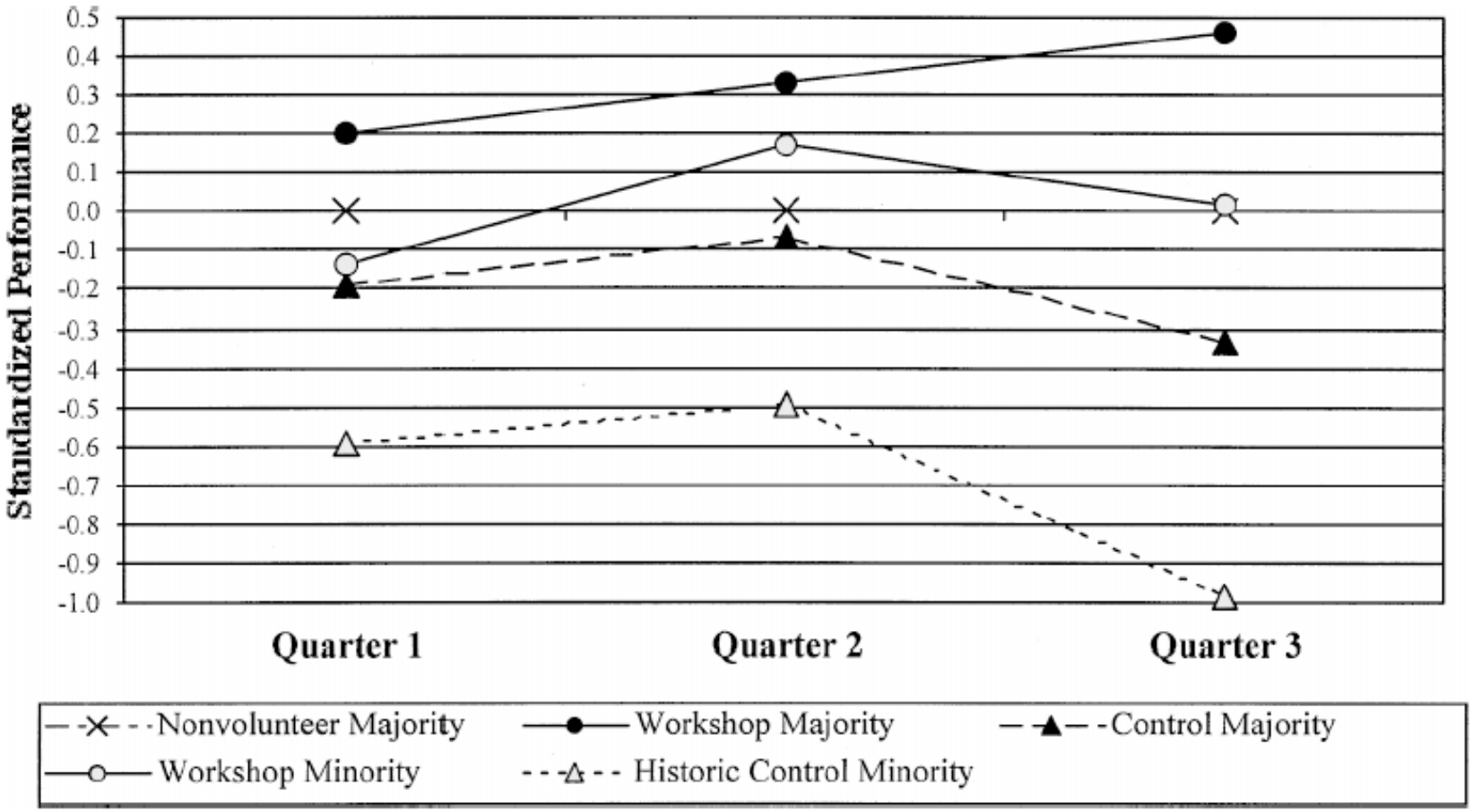
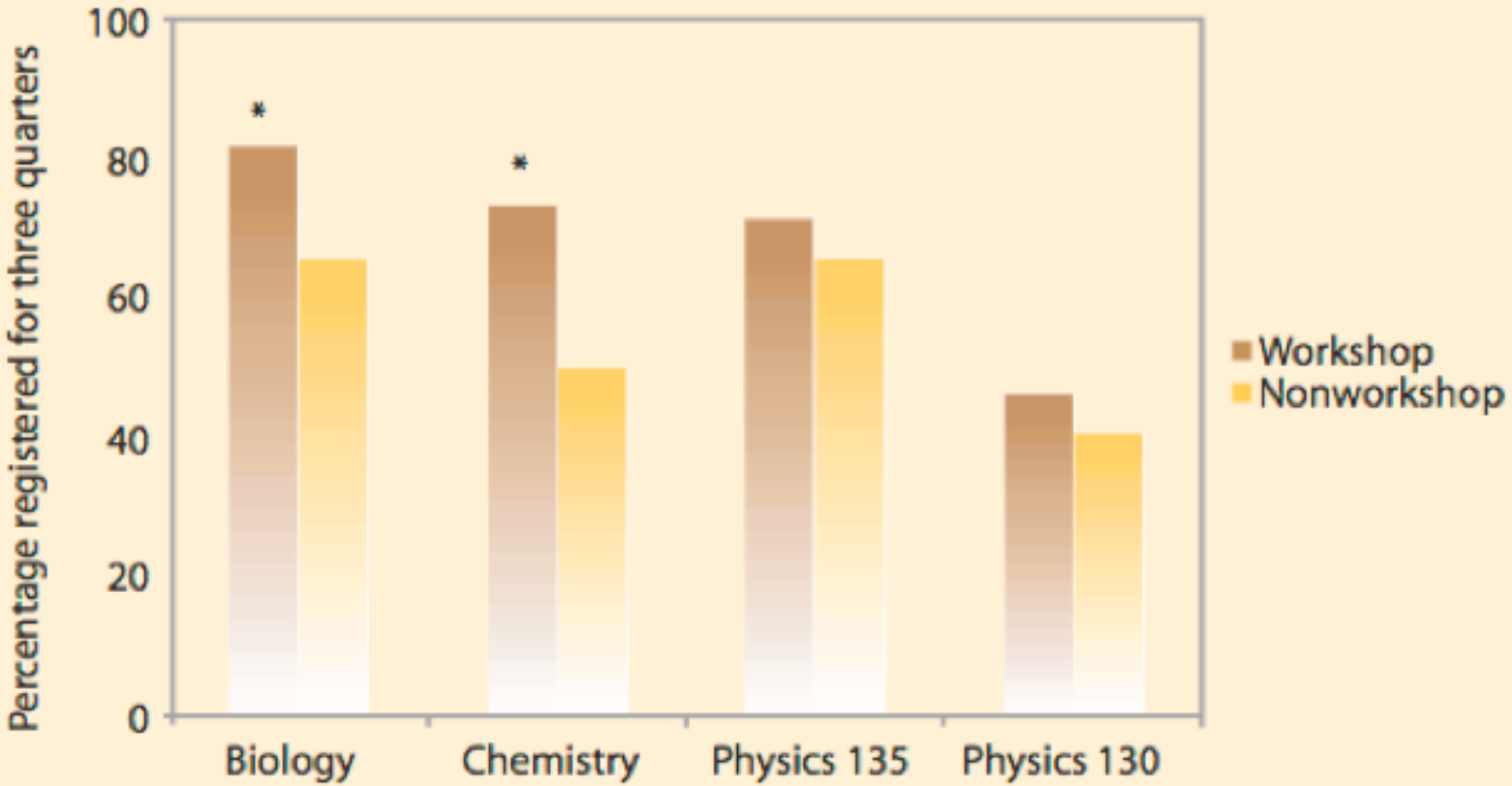


Fig. 2. Standardized performance in each quarter as a function of group, controlling for prior cumulative grade point average.

Swarat, S. and Drane, D. and Smith, H.D. and Light, G. and Pinto, L., 2004

FIGURE 2

2001–2002 all student retention over three quarters by workshop participation and discipline.



Retention is defined as the proportion of students who complete all three quarters of the course sequence.

*Significant chi square, $P < 0.05$

Important problems can be examined by the use of randomized field trials

1. Observational studies are useful, but are very susceptible to problems of subject participation.
2. Marriage leads to happiness, but only amongst those who stay married.
3. Healthy diets prolong life, but perhaps for those who do other healthy activities.
4. People who volunteer for studies are different than those who do not.