

10-1-2013

Receptivity Curves: Educational Research and the Flow of Ideas: Expanded Version

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Jacobs, Jerry A. 2013. "Receptivity Curves: Educational Research and the Flow of Ideas: Expanded Version." Population Studies Center, University of Pennsylvania, *PSC Working Paper Series*, PSC 13-10. http://repository.upenn.edu/psc_working_papers/50

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A shorted version of this paper with fewer examples was published as:

Jacobs, Jerry A. 2013. "Receptivity Curves: Educational Research and the Flow of Ideas." Chapter 6 of *In Defense of Disciplines: Interdisciplinarity and Specialization in the Research University*. Chicago, IL: University of Chicago Press. This paper is cited as Jacobs, 2013b, in the reference section of *In Defense of Disciplines*.

Receptivity Curves: Educational Research and the Flow of Ideas: Expanded Version

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Introduction

Advocates of interdisciplinary collaboration suggest that scholarship be organized around topics rather than disciplines (Geiger and Sa, 2008; for a review, see Jacobs and Frickel, 2009). This approach, it is suggested, will enable researchers to peer over the restrictive walls of their disciplinary silos and learn about indispensable ideas being developed by scholars in neighboring fields of study. Breaking down arbitrary disciplinary boundaries, so the argument goes, will be the key to solving our most pressing and important problems, from poverty to pandemics to global warming.

If a topical rather than a disciplinary focus were the key to solving our most vexing intellectual challenges, then schools of education would be at the forefront, a model for the rest of academia to emulate. Schools of education bring scholars together from disparate fields, including specialists in developmental psychology, language instruction, reading, student counseling, administrative leadership, as well as a relatively small number of anthropologists, economists, historians, sociologists, and other disciplines. No one discipline claims ownership of all aspects of education, and thus the interdisciplinary ideal is alive and well in schools of education.

Yet many have been critical of scholarship in education, especially historians of educational research. For example, Labaree (2004) and Langemann (2000) bemoan the fact that education typically finds itself at the bottom of the academic pecking order. Walters, Lareau and Ranis (2009) represent an exception to the downbeat assessment of educational scholarship. Thus, it would appear that organizing scholarship around topics rather than disciplines by itself is not sufficient to overcome the intellectual challenges associated with improving our educational system.

A related complaint has been raised concerning the lack of connection of education scholarship to the main disciplines. For example, Lagemann laments "...the isolation of educational study from other branches of university scholarship..." (2000:232). For Lagemann, the low status of education in the academic hierarchy is both the cause and the effect of its distance from other fields. "Clearly deriving from multiple sources, the low status that has plagued educational scholarship from the beginning has

had several discernable and unfortunate effects, the most important having been the distance it has encouraged between educationists and their peers in the arts and sciences and other professional fields (2000, p. 233)."

This comment is puzzling from the vantage point of interdisciplinarity. The problem as Lagemann sees it is that education suffers from not enough disciplinarity, since the arts and science disciplines are prime sources of intellectual dynamism. The irony, then, is that the more applied divisions of the academy are calling for more disciplinarity at the same time that others are criticizing these same disciplines for their insularity and lethargy.

This study focuses on the complaint that education suffers from a distance from academic disciplines. The goal of this study is to ascertain whether there is any truth to this particular charge. Are educationists unaware of the latest academic developments? Do they fail to incorporate the latest ideas and statistics in their research? Do the broad currents coursing through the main ivy-covered quadrangles fail to have enough wind behind them to carry over to the education courtyards? There has been little empirical research on this issue. This study seeks to fill this gap.

Of course the opposite complaint has also been leveled: that educational research is too focused on raising the status of schools of education in the academy, and consequently this scholarship becomes too removed from the everyday concerns of improving schools. Indeed, the sentence by Lagemann quoted above includes both charges: "the isolation of educational study from other branches of university scholarship as well as its relative remove from practice (2000:233)." My goal here is not to suggest the best research strategies for education scholars to pursue but simply to assess the degree of intellectual distance between scholarship in education and that in other academic disciplines.

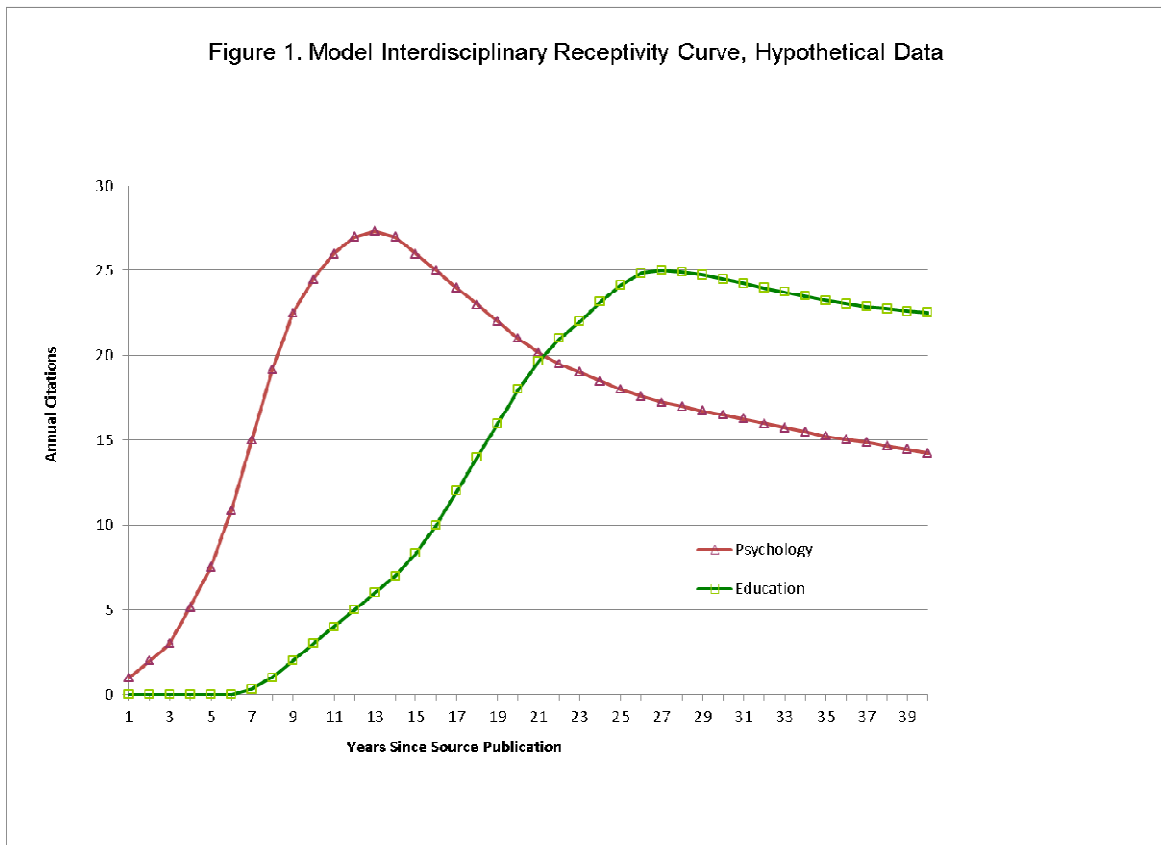
1. Defining Intellectually Remote Fields via Receptivity Curves

Let us define an intellectually remote field of study as one where new ideas are slow to filter in and even slower to be discarded. This definition depends on the relative rates of receptivity to new ideas. In a remote field, new ideas are slow to be accepted; moreover, old ideas tend to stay in currency long after they are discarded in adjacent fields.

To make this description more concrete, let's compare the impact of a major innovation in two fields, education and psychology. Specifically, let's take the reception of a specific new idea (one may think of an important book or article by Piaget, Bandura or Wechsler) as indicator of the receptivity to new ideas, and also as an indicator of the adherence to old ideas. If education were slow to pick up an important new idea or intellectual development, then there would be fewer citations to this work in the years immediately after its publication. If psychologists quickly absorbed these new insights while educationists were slow to do the same, then this might be taken one indication that education is outside the main currents of intellectual advancement. Similarly, let's imagine that, after a lengthy delay, educationists finally pick up the new idea but then continue to adhere to it long after it had been abandoned by psychologists and other

scholars. Again, this could be taken as evidence that the field of education is behind the curve of related academic disciplines.

The logic sketched out here is represented in graphic form in Figure 1. The graph depicts hypothetical data on the annual citation rates to a new idea in two fields, education and psychology. In this figure, education is shown to be slow on the uptake of a new idea, relative to psychology. Thus, in the first few years after the publication of the article or book in question, the citation counts mount quickly in psychology but accumulate only slowly in education. As the citation lifecycle of the article begins to peak in psychology, scholars in education finally catch on and begin paying attention. Ironically, the idea in question has already begun its downward slope in psychology, as it has begun to be superseded by newer ideas and intellectual advances. However, even as psychologists are moving on to greener intellectual pastures, scholars in education are just becoming enamored of this dated contribution.



Thus, for a period of time, psychology is turning away from an idea even as it is still on the upswing in education. In the hypothetical example depicted in Figure 1, the idea in question is on a downward trajectory in psychology after (post-publication) year 13, when the idea was at its peak of popularity and influence in the field. However, educationists continue to flock to this idea for more than another decade. In our

hypothetical example, it takes until year 27 for the idea to reach its apex in education. Furthermore, if education were intellectually remote from psychology, then references to the work in question in education journals might last years longer than in other fields. This gap can be observed on the right-hand side of Figure 1, where the downward slope of citations is gentler in education than in psychology.¹

I will refer to the graphs representing citation trajectories or histories as “receptivity curves.” The question on the table is whether the receptivity curve in education lags behind its companion in psychology and those in other adjacent academic disciplines. We will scrutinize this question with regard to the early diffusion period on the left of the graph as well as the persistent adherence stage on the right side of the graph.

Of course there is no gold-standard measure of how fast an idea should diffuse, nor is there a measure of how long that idea should remain in currency. All these curves can indicate is the relative pattern observed in different disciplines. If we assume that the traditional academic disciplines such as psychology, economics, anthropology, sociology and the like are the source of many new ideas, then any gap between these fields and education may be taken to represent delayed receptivity in the intellectual development in the field of education. Specific examples will be considered so that readers can judge the appropriateness of this assumption in particular cases.

We will also scrutinize ideas moving in the reverse direction as well: do ideas developed in education diffuse outward to related disciplines in a timely fashion? In considering the export of ideas from education to other fields, we will add yet another technique to our kit, namely the analysis of citation rates of entire journals.

Finally, we will consider the category of “ideas in the zeitgeist,” namely ideas which have no readily identifiable source. We can examine whether common terms such as “globalization” make their way into education at a faster or slower rate than into other fields.

The research strategy here follows the lead of Rinia et al. (2001), who examined citation lags across disciplines. They showed that intra-disciplinary citations, that is, citations occurring in journals in the same field as the original publication, tended to appear slightly earlier than citations to the same research published in other fields.²

Walters, Lareau and Ranis provide a list of research that is highly cited in education journals (2009, p. 2002). The openness of education as a field to research

¹ Lagemann makes just this point when she suggests that “educationists continued to churn our school surveys long after sociologists and anthropologists had begun to develop more nuanced approaches to community study... (2000, p. 233-234).”

² My reading of this research is that the gap between intra- and inter-disciplinary citations is remarkably small, typically less than one year. I was also struck by the number of cases in which the pattern was reversed: namely, where interdisciplinary citations actually occurred faster than disciplinary citations. Out of 15 disciplines in the natural sciences examined, Rinia and colleagues report 8 where internal references appeared faster, usually by about ½ year; in four cases, internal and external references were about as old, and in three cases, external references were faster than internal ones.

conducted in other disciplines should be evident from the list that Walters and her colleagues compiled. Most of the scholars cited on this list are not faculty in schools of education but rather were affiliated with departments of psychology. In one case discussed below, Keith Stanovich, a scholar who has done important research on reading, has published influential research in education journals while his academic appointment is in a department of applied psychology. Ann Leslie Brown is perhaps the clearest case of a highly cited scholar whose is an educationist with a primary appointment in education. If education were closed to outside influences, Walters' list would be dominated by educationists.

The useful list compiled by Walters and her colleagues does not indicate whether the same research is cited in other fields, nor does it indicate which fields latched onto these ideas first. This study builds on their research by comparing the reception of research in different fields and especially by focusing on the reception trajectories of particular studies.

I drew on the list developed by Walters and her colleagues, as well as a number of other studies, to examine the timing of reception to individual pieces of scholarship. I sought to cover the interface between education and various disciplines, including psychology, sociology, education, statistics and the humanities. I also examined the diffusion of research terms, such as human capital and globalization, across disciplinary boundaries. Finally, I shifted the unit of analysis from individual papers to journals by comparing the intra- and inter-disciplinary citation lags for a series of prominent education journals.

The analysis reported here depends on annual citation counts and disciplinary classifications. I rely on the ISI Web of Knowledge system for the data presented here. This system is not entirely comprehensive: it does not include all academic journals and it does not include citations which appear in books (see Jacobs, 2009 for a discussion of these issues). Nonetheless, the Web of Knowledge covers millions of citations to research papers published into thousands of journals, and offers a consistent system for classifying journals into disciplines. It is the basis for many papers published in the area of library science, information science and bibliometrics, and thus represents a reasonable place to begin.

2. Education and Psychology

Does the typical receptivity curve fit the picture laid out in Figure 1? Let us begin by considering the reception of a major figure in the field of developmental psychology, Jean Piaget. Did developmental psychologists rush to Piaget's banner more quickly than did their counterparts in education? And did educationists maintain loyal to Piaget even after the field of educational psychology had moved on? To develop empirical examples that fit the logic mapped out in Figure 1, we need annual citation data, and we need to have a specific original publication date. Thus, it makes the most sense to examine citations to a particular article or book.

The first example considered is the reception of a major scholar in the field of developmental psychology, Jean Piaget, who developed a stage theory of children's growth that encompassed their intellectual, social, and moral development. Figure 2a maps citations to Jean's Piaget's book, *in Children. The Origins of Intelligence* This particular work of Piaget has accumulated a large number of citations in the fifty-six years since its publication in 1952. It is remarkable that the influence, or visibility, of this work increased steadily for 30 years after its publication. It is also quite a testament to Piaget's influence that citations to this work endure through the present: a staggering 150 citations per year to this book are regularly recorded in academic journals indexed by the ISI Web of Knowledge. There are good reasons to believe that this understates the full extent of Piaget's influence.³ Figure 2a compares the citation trajectories to Piaget's work in academic journal articles published in the fields of education and psychology. This comparison is based on the disciplinary classification of journals devised by the Web of Knowledge.

What can we learn from the citation trajectories in Figure 2a? As a general summary, it seems fair to say that the curves for psychology and education resemble each other a great deal. There are fewer citations in education than in psychology, but that is just a matter of the relative size of the two fields. There was no delay in the arrival of Piaget in education journals, as indexed by scholarly citations. If anything, the upward trajectory of citations to Piaget in education was a bit steeper over the first 15 years post-publication than was the case in psychology. In psychology, citations to Piaget increased through year 30. Education also saw a spike in citations in year 30, although the peak citation year in education is actually a few years earlier. Psychologists appear to be a bit more reluctant to move on from Piaget than their educational colleagues: over the last 20 years, the slope in citations appears to be slightly downward in education but close to flat, with annual fluctuations, in psychology.

³ Jacobs (2009) shows that Google Scholar captures a larger volume of citations than does the ISI Web of Knowledge, in part because it covers books as well as articles, and in part because it is more comprehensive with respect to the coverage of journals.

Figure 2a. Citations to Jean Piaget, *Origins of Intelligence in Children*

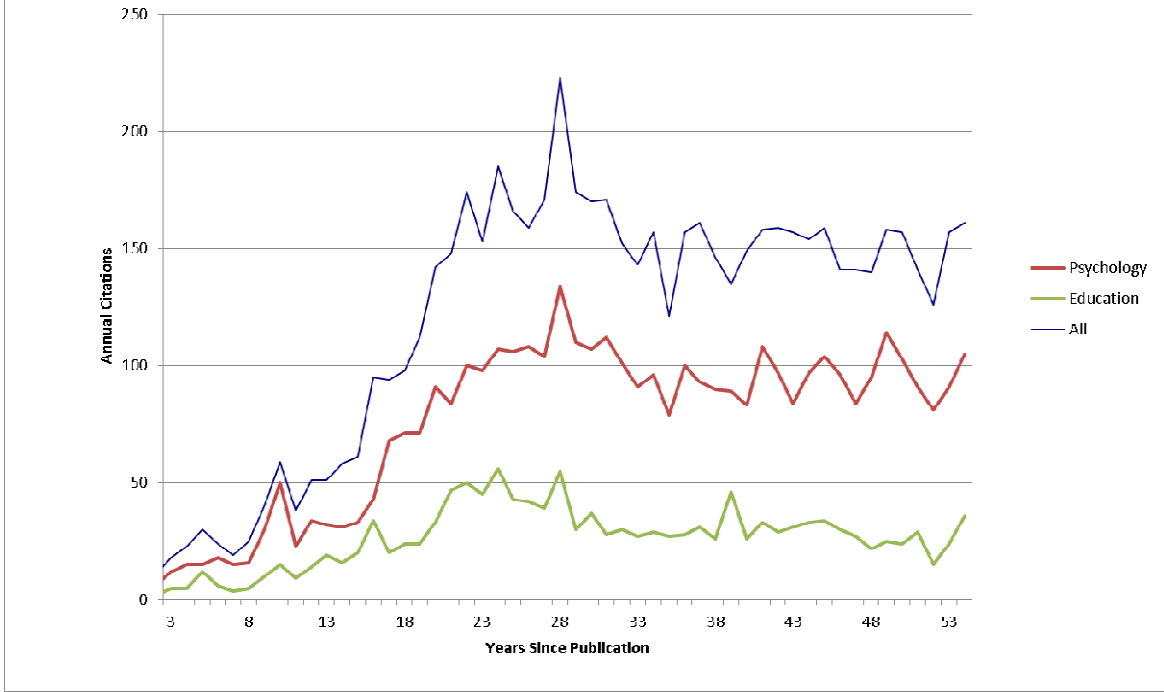
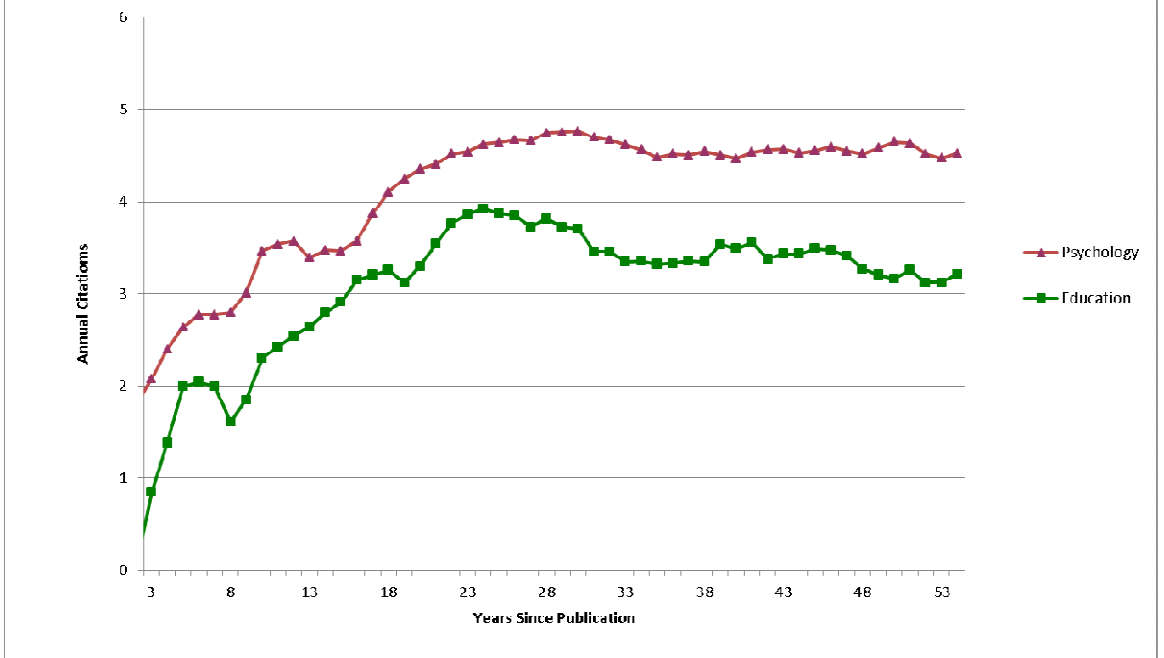


Figure 2b. Jean Piaget, *Origins of Intelligence in Children*:
Logged Annual Citations; 3-Year Running Average



The parallels between education and psychology appear even more clearly in Figure 2b, which presents the natural log of citation counts. This adjustment makes it easier to compare curves with marked differences in scale. This citation data are also presented as a three-year running average in order to smooth-out year to year fluctuations. Figure 2b shows a similar rate of receptivity to Piaget's work in psychology and education over the first 25 years after publication. After year 25, there was continued interest in psychology and a slight decline in interest in education. This pattern of receptivity for this particular work of Piaget does not fit the "intellectually remote" model outlined in Figure 1.

The reception of two other prominent books by Piaget follow much the same pattern: more citations overall in psychology than in education; a similar rapid rate of early citations; a peak of interest in education a bit earlier than in psychology; and greater long-term enduring interest in psychology compared to a slight downward trend in citations in education. (See Figures 3 and 4 for receptivity curves for *The Construction of Reality in the Child* (1954) and *Play, Dreams and Imitation in Childhood* (1952).

Figures 5a and 5b takes up the same questions with a very different figure in psychology: Albert Bandura. An influential work is Bandura's 1995 *Self Efficacy in Changing Societies*. This example enables us to consider the influence of a different type of psychology written more recently than the books we considered by Piaget, thus allowing us to examine diffusion during a different historical period. Bandura's "social learning theory of aggression" departed from the behaviorism of B. F. Skinner by stressing the way human behavior, especially among the young, could be understood as modeled on the activities of others.

Figure 3. Citations to Jean Piaget, Construction of Reality (1954)

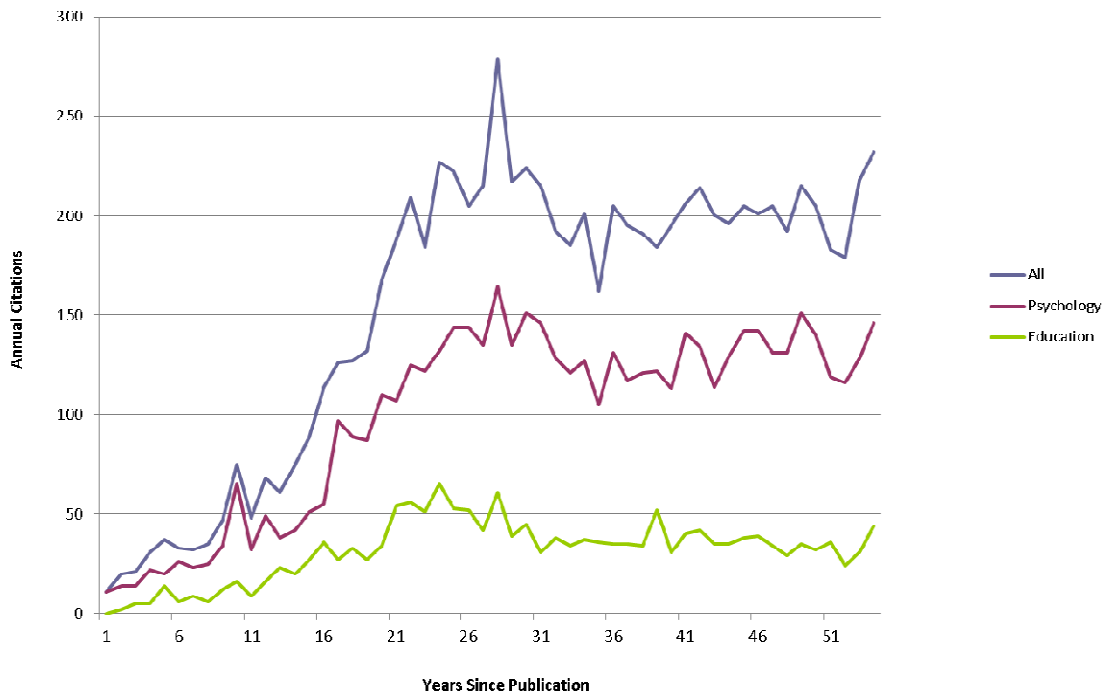


Figure 4. Citations to Jean Piaget, "Play, Dreams and Imitation (1952)"

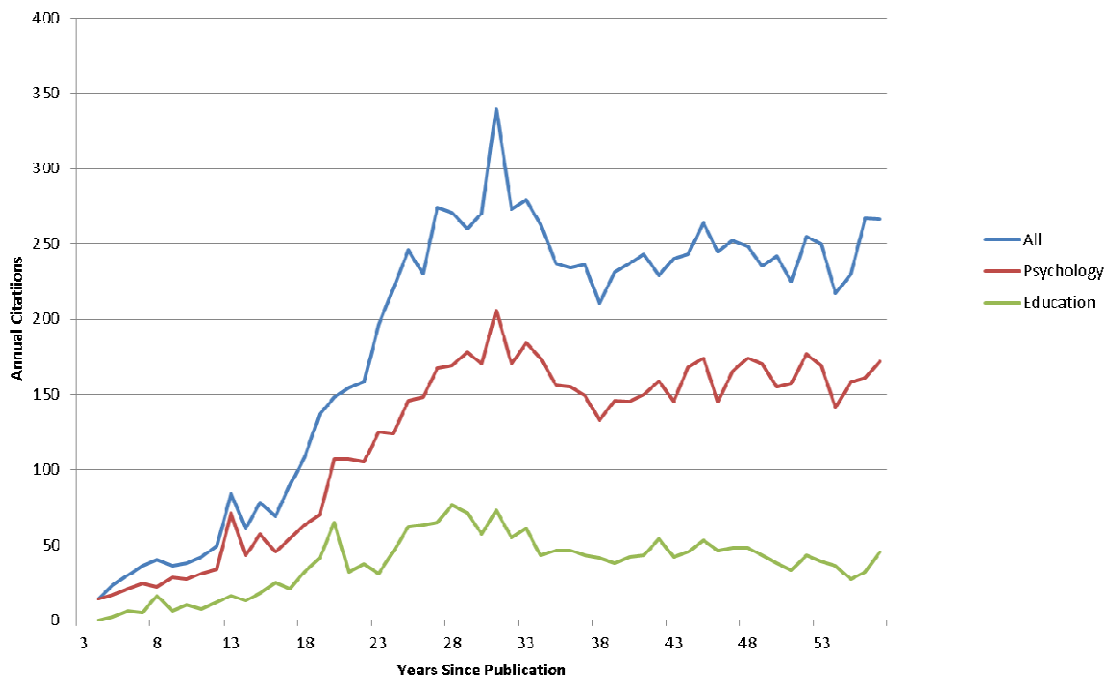


Figure 5a: Self Efficacy in Changing Societies (Bandura, 1995)

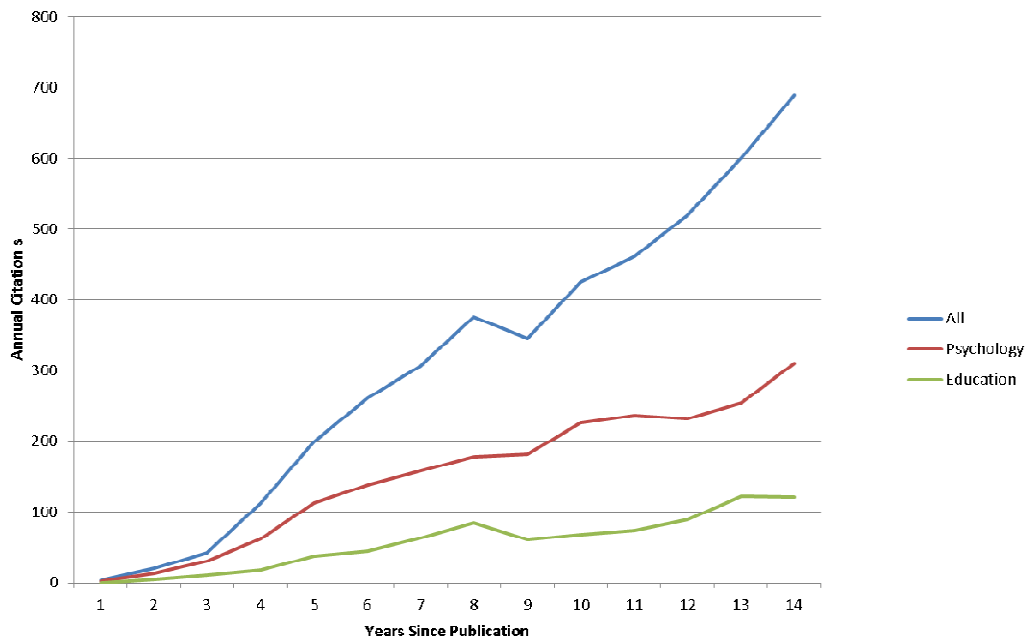


Figure 5b: Self Efficacy in Changing Societies (Bandura, 1995) Logged Citations

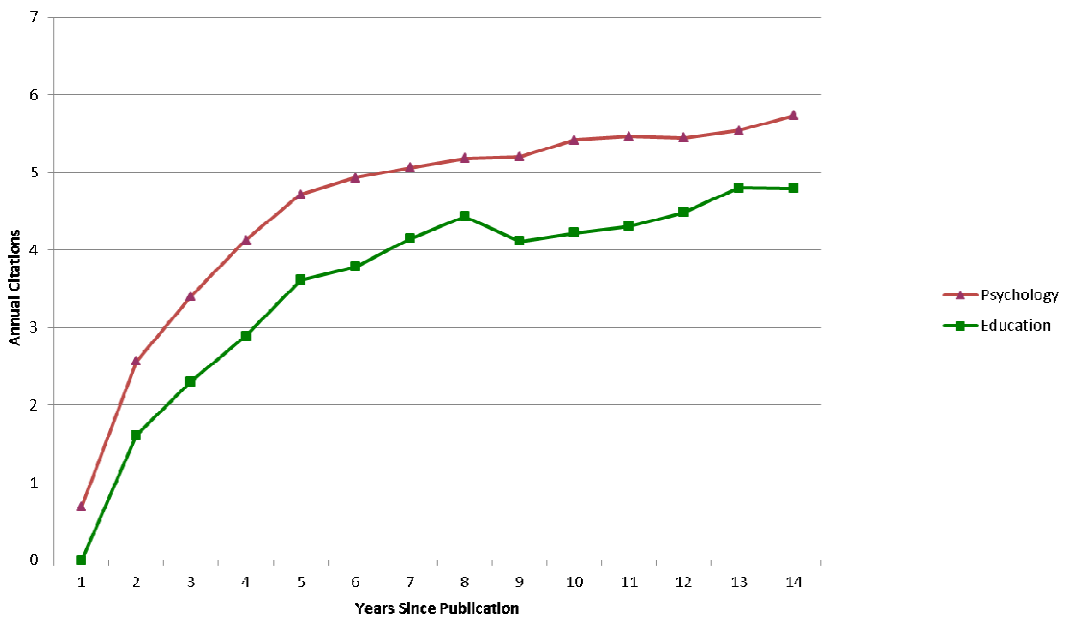


Figure 6a: Social Learning Theory of Aggression (Bandura, 1971)

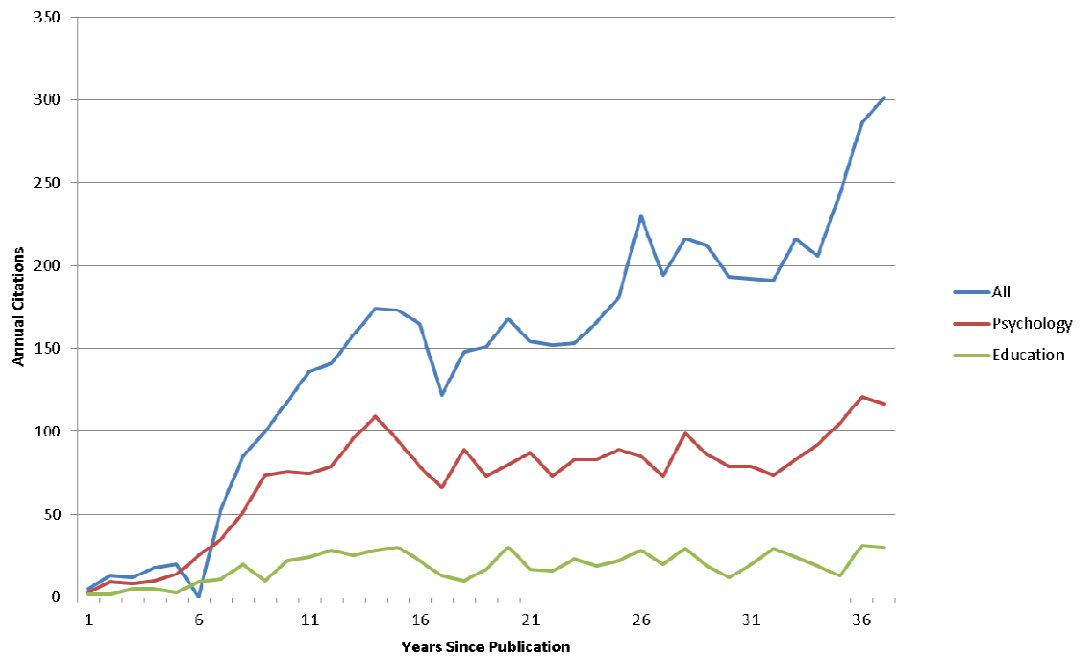
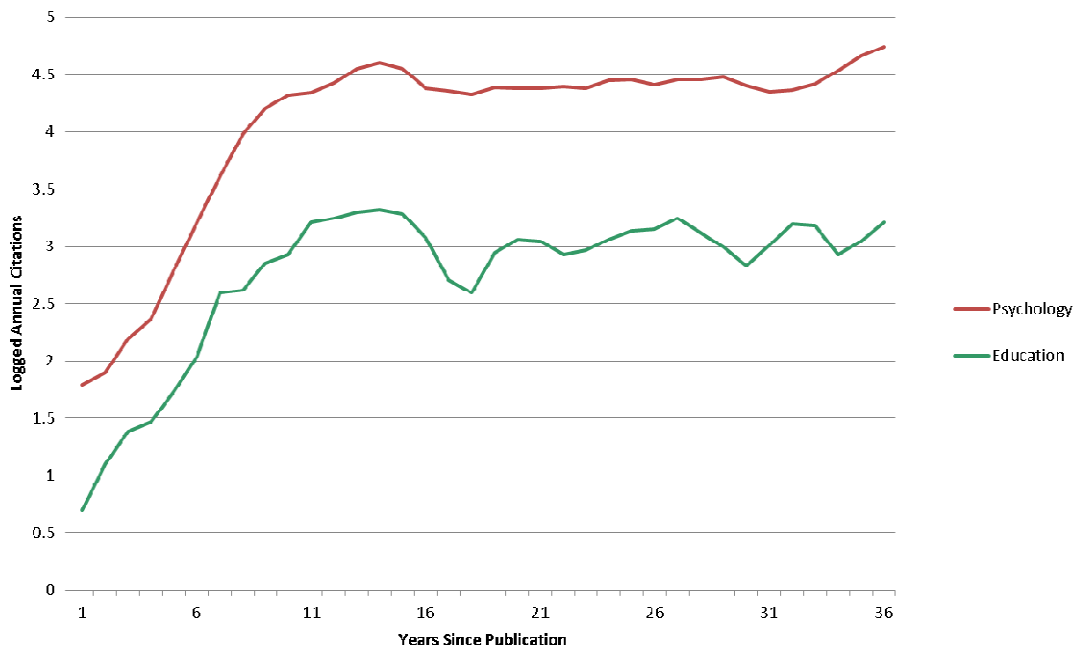


Figure 6b: Social Learning Theory of Aggression (Bandura, 1971) Logged Citation Counts



Figures 5a and 5b present the receptivity curves for this piece of scholarship. Bandura's 1995 book is rapidly on its way to receiving 700 or more citations per year, a truly remarkable degree of influence, with education journals generating approximately 100 citations per year and psychology journals 300. The climb in citations is roughly a straight line in both fields with no clear inflection point. The logged citation graph (Figure 5b) makes it clear that the main difference between education and psychology is scale: the

trajectory is similar for these two fields, while the absolute volume of citations is higher in psychology. Here again, there is no evidence of delayed reception in education.

Another notable work is Bandura's "social learning theory of aggression," published in 1971. This study had a peak in influence about 15 years after its initial publication. The pattern again appears quite similar in education and psychology after we take into account the fact that the overall number of citations in education journals is lower (see Figures 6a and 6b.) This example is somewhat unusual in that there was a resurgence of interest in Bandura's book 25 years after its publication, and another surge in interest about 35 years after publication. (Some of these peaks in overall citations are due to citations outside of education and psychology.) Perhaps the publication of Bandura's 1995 volume helped to rekindle interest in his earlier work.

The parallels between education and psychology are again a bit clearer to see in Figure 6b, which presents the logged and smoothed citation curves. The two curves track each other, allowing for differences in levels, quite closely over the first fifteen years after publication. There was perhaps a bit more of a decline in citations in education than in psychology, but citations to Bandura's book persist on a plateau in both fields for twenty years after its publication.

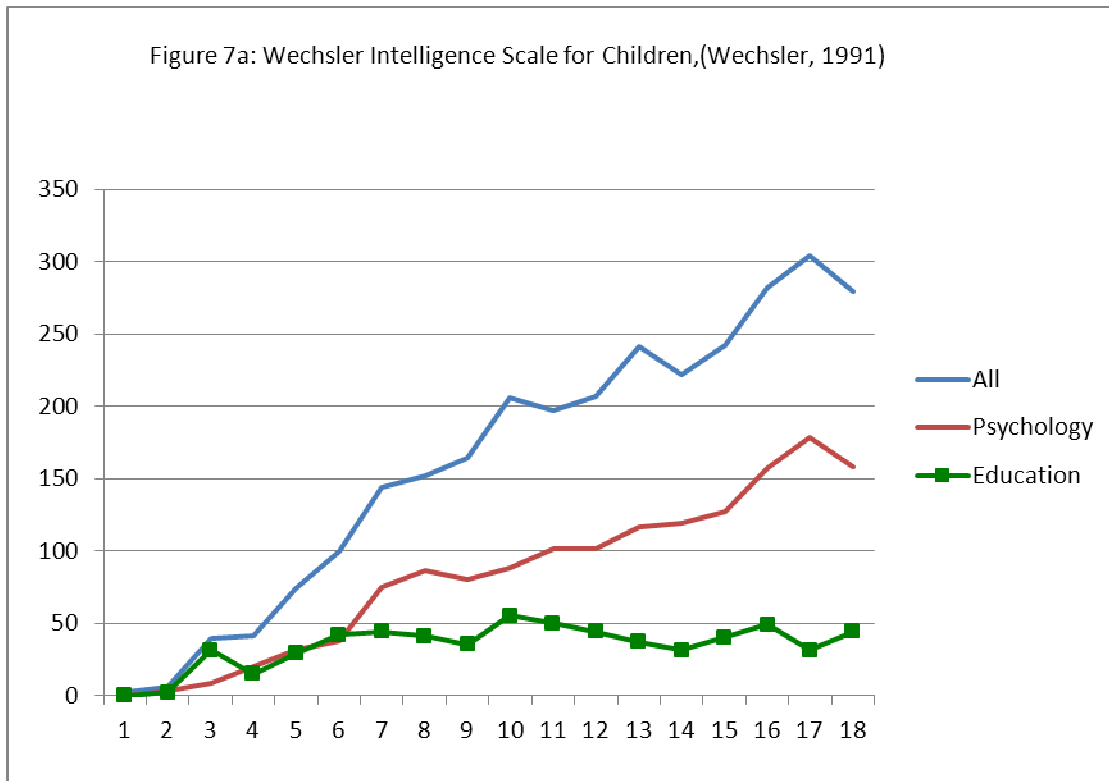
Let us turn to a third psychologist, David Wechsler, whose work on the measurement of intelligence has been very influential. Figures 7a and 7b present the receptivity curves for Wechsler's 1991 children's intelligence scale. The citations to this publication actually rise a bit more quickly in education than in psychology. This can be seen in Figures 7a and 7b. By the third year after the publication of Wechsler's work, it was already widely cited in education. The peak citation year in education journals occurs ten years after publication, but one can also see a plateau in citations from roughly year 7 through year 19. The rapid assimilation of this particular intelligence scale may be due to the fact that it was an updated version of scales that Wechsler had developed years before. While psychologists were also quick to cite Wechsler's 1991 work, the citation count continued to rise in psychology through 2007.

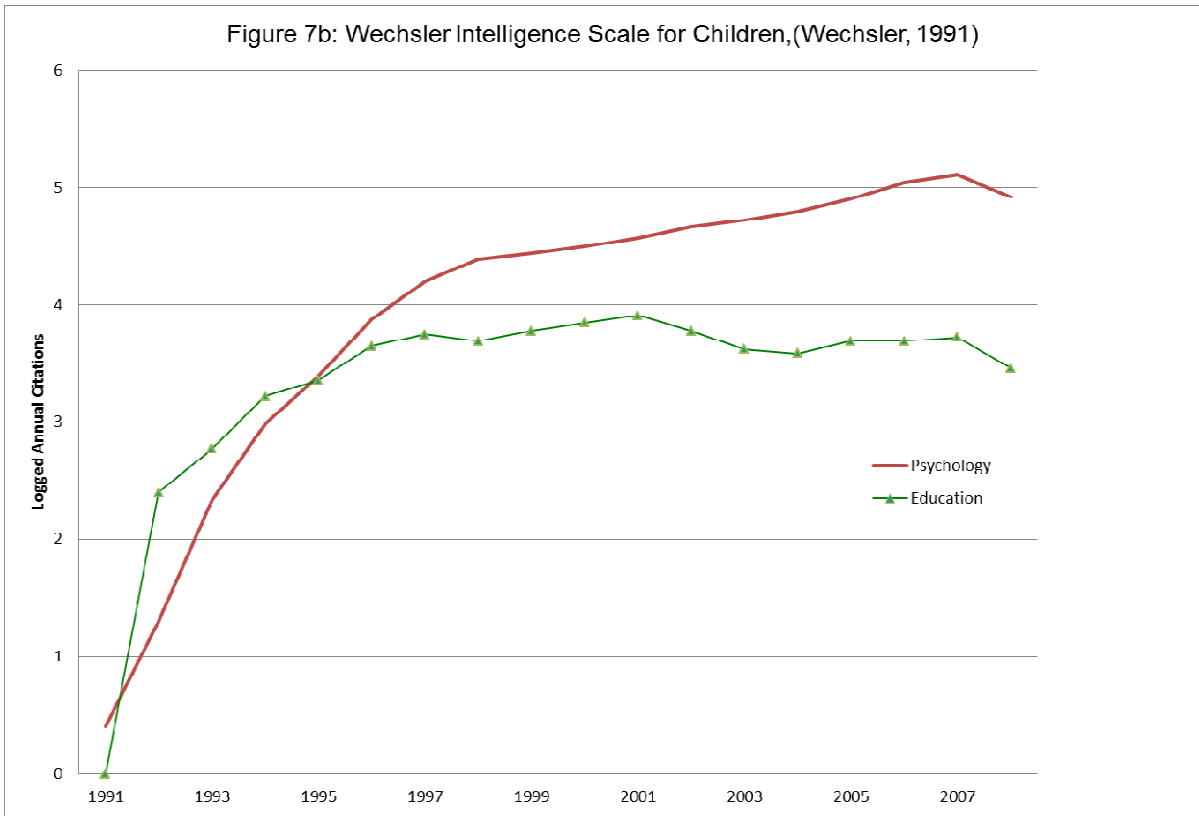
Some might object that by focusing on these top-cited figures, this strategy unduly emphasizes those papers which have managed to span disciplinary silos. An important question, then, is whether less cited papers have a similar pattern of interdisciplinary as these exceptionally influential works.

This question is addressed in Table 1. Here the top cited papers in each of five journals are compared with less influential research. In four of the five cases, there is as high a rate of interdisciplinary citation for the less visible papers as for the top-cited

articles. These results suggest that the interdisciplinary trajectories for less cited papers may not be terribly different from the top-cited papers discussed here.

There is a second, important reason for focusing on these top-cited papers. Academic scholarship is a rather skewed activity: a relatively small number of figures have a terribly disproportionate degree of visibility or influence (Brouthers, Mudambi and Redd 2012). Given this pattern, a focus on these most influential works is appropriate, since they have the most influence on the direction of research.





| Table 1. Diffusion Rates for Top Cited Articles versus All Articles | | | | | | | |
|--|------------------------|-----------|-------|--------------------|--------------|-----------|-------|
| Do top cited articles get cited outside of their field more than other articles? | | | | | | | |
| In four of these five journals, the answer is "no." | | | | | | | |
| Journal | 100+ citation articles | Education | Other | Number of Articles | All Articles | Education | Other |
| Harvard Educational Review | | 57.8% | 42.2% | 9 | | 48.8 | 51.2 |
| Educational Evaluation and Policy Analysis | | 59.8% | 40.2% | 5 | | 64.4 | 35.6 |
| Teachers College Record | | 66.5% | 33.5% | 8 | | 68.2 | 31.8 |
| American Education Research Journal | | 55.5% | 44.5% | 47 | | 54.2 | 45.8 |
| Review of Educational Research | | 51.8% | 48.2% | 103 | | 52.2 | 47.8 |

3. Education and Sociology

As we have seen, there are extensive intellectual connections between psychology and education. The evidence suggests the relatively free flow of ideas from psychology into education, and counters the disparaging suggestion that schools of education represent an intellectually remove province in the otherwise dynamic institution of higher

education. Is the same pattern evident for sociological research? Sociologists have been interested in educational issues since the writings of Parsons and Durkheim.

There are good reasons to expect that, compared with psychology, sociological research may not flow as easily into educational journals. The main barrier is the scarcity of sociologists on the faculty of schools of education. Table 2 displays the doctoral degree fields of faculty who specialize in education. The data are drawn from the National Survey of Post-Secondary Faculty. The row for sociology suggests that barely over half of one percent of ed-school faculty have a degree in sociology. In contrast, more than six percent (6.65 percent) of education faculty have degrees in psychology, if one combines faculty with psychology degrees (1.69 percent) with educational psychology degrees (4.96 percent). This fact no doubt could contribute to the permeability of ideas between psychology and education.

We begin this section with two contributions by James Coleman. The famous 1966 “Coleman Report” suggested that parental social background was more influential in shaping students’ educational destinations than school factors such as spending per pupil. This study raised many concerns on the part of educators, and introduced regression analysis to a generation of educational researchers.

As shown in Figure 8, which presents the three-year running average of citations, Coleman’s work became visible very quickly in education journals after its publication as “Equal Educational Opportunity” in 1966. The reception was a bit slower in sociology journals than in education journals, but in both fields the influence of this research peaked during the 1970s. The similarities between the receptivity of these two fields to Coleman’s work is easy to see in Figure 8.

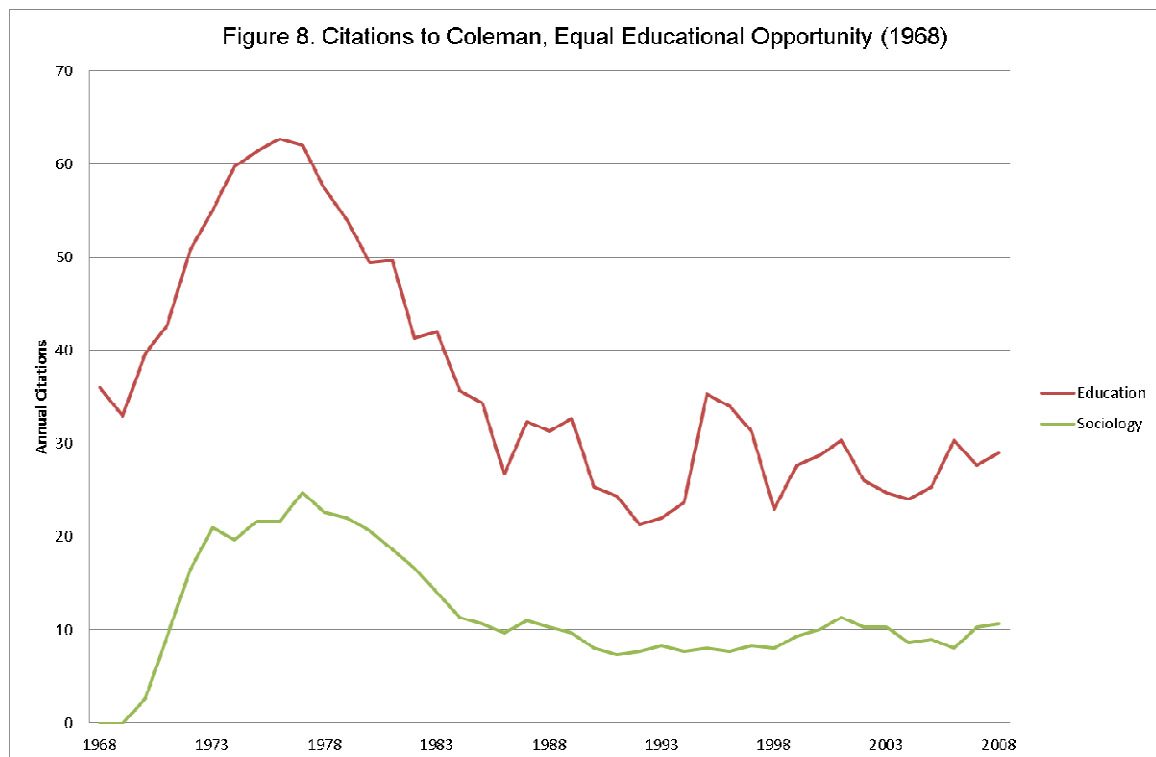
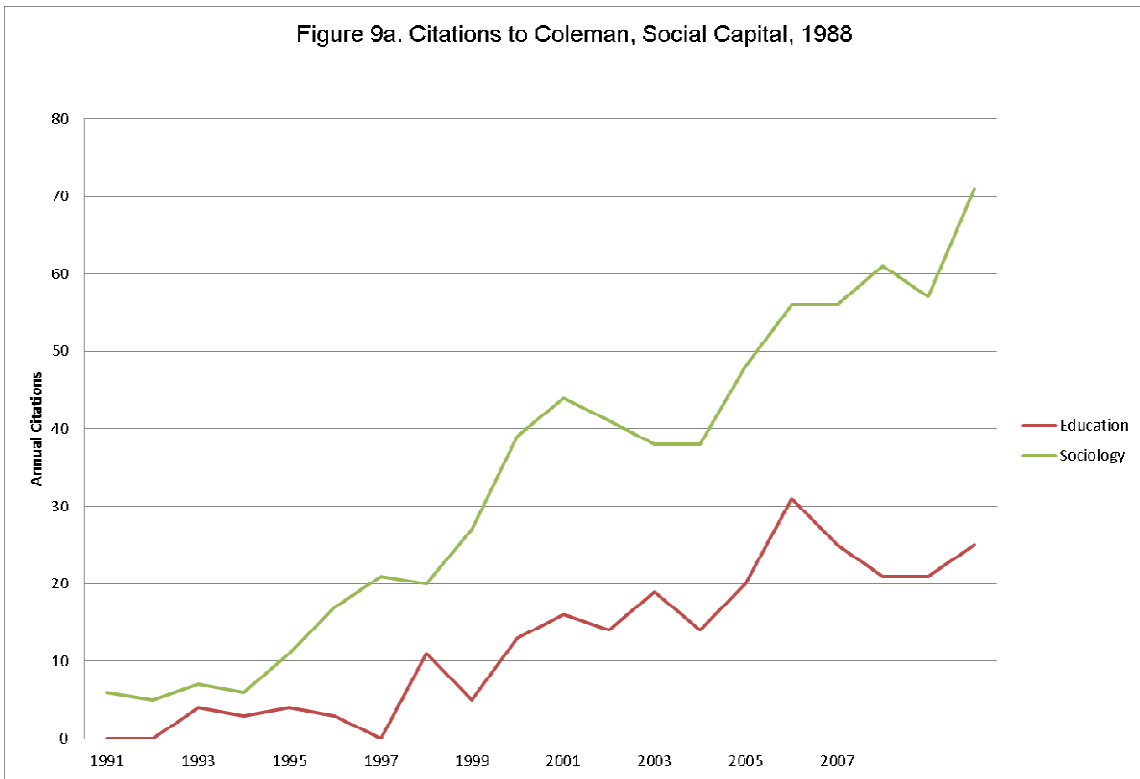
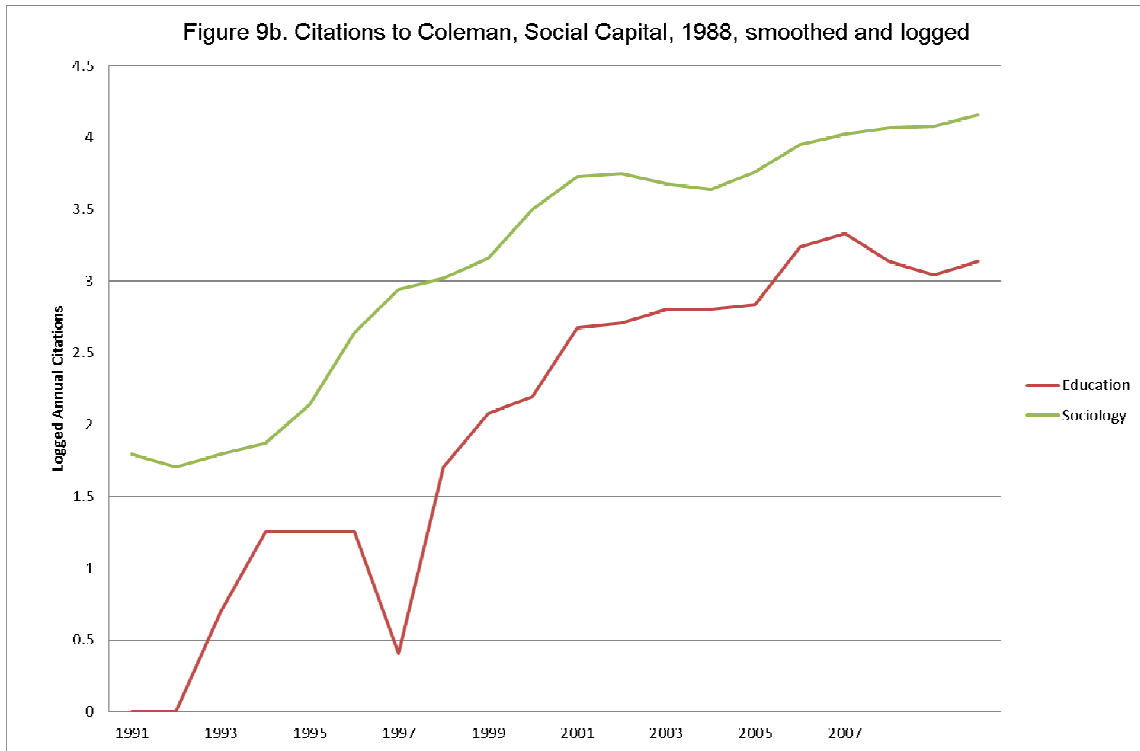


Figure 9a. Citations to Coleman, Social Capital, 1988

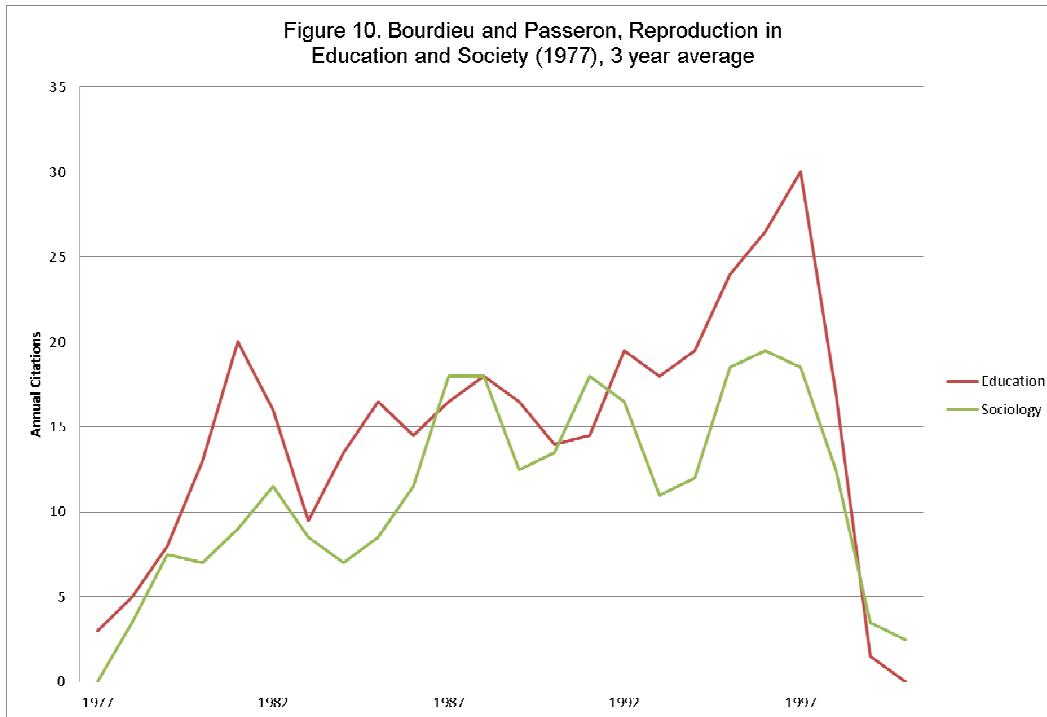




Figures 9a and 9b examine the reception of Coleman’s 1988 paper in the American Journal of Sociology on “social capital.” This study emphasized the importance of parents’ social networks. Coleman’s 1988 paper has been cited more extensively in sociology than in education, but there is little evidence of a delayed reception of this research. The logged curve shows a largely parallel reception in sociology and education, with a brief downward blip in education journals during the late 1990s.

Pierre Bourdieu is another interesting scholar to consider. Again, there are good reasons to expect that Bourdieu might not be widely read by education scholars. He is French; his writings can be difficult to digest; and his largely theoretical work may apply more to France than to the US. Nonetheless, Bourdieu’s work has been rapidly absorbed by educationists. Figure 10 traces the reception of Bourdieu and Passeron’s *Reproduction in Education, Culture and Society* (1977). The receptivity curves for education and sociology closely overlap one another. In fact, this volume is cited somewhat more frequently in education than in sociology. It is interesting to note the rapid decline in citations to this volume during the late 1990s. This is due in part to citations to a revised edition of “Reproduction” published in 1990; in part to citations to other writings of Bourdieu, and in part to a broader pattern of the declining influence of earlier studies.

Based on the reception of Coleman and Bourdieu’s contributions, we may conclude that the barriers to communication between sociologists and educationists are not that great. The most influential and most visible work is read and cited at remarkably similar rates across these two fields of scholarship.



4. Education, Economics and Statistics

While the connections of educational researchers to their counterparts in psychology and sociology seem quite strong, the ties to economics are much weaker. The relatively slow reception of economic ideas in education journals may reflect the very small number of scholars trained in economics with appointments in schools of education. As

can be seen in Table 2, about one quarter of one percent of faculty in schools of

| | |
|---|-------|
| Agriculture (101-110) | 0.69 |
| Architecture & Design (130) | 0.08 |
| Art (141-150) | 1.13 |
| Business & Management (161-170) | 1.43 |
| Communication (181-190) | 0.62 |
| Computer Science (201-210) | 0.58 |
| Education Total (221-250) | 79.20 |
| Education, General, Basic, Other (221, 222) | 18.18 |
| Bilingual, Cross-Cultural (223) | 0.18 |
| Curriculum and Instruction (224) | 13.41 |
| Ed. Administration (225) | 7.44 |
| Ed. Evaluation & Research (226) | 1.51 |
| Educational Psychology (227) | 4.96 |
| Higher Education (228) A1 | 3.01 |
| Special Education (229) | 7.65 |
| Student Counseling (230) | 6.52 |
| Teacher Education (241-250) | 16.31 |
| English & Literature (291-300) | 3.55 |
| Foreign Languages | 0.21 |
| Health Sciences (331-340) | 1.38 |
| Home Economics & Industrial Arts (350-360)* | 0.75 |
| Law (370) | 0.11 |
| Library Science (380) | 0.30 |
| Mathematics (390) | 0.64 |
| Biological Sciences (391-400) | 0.45 |
| Physical Sciences (411-420) | 0.67 |
| Philosophy, Religion & Theology (440-442) | |
| Physical Education (470) | 0.23 |
| Psychology (510) | 1.69 |
| Public Affairs (520) | 1.07 |
| Science Technologies | 0.15 |
| Anthropology (542) | 0.65 |
| Area and Ethnic Studies | 0.75 |
| Economics (546) | 0.25 |
| History (548) | 0.54 |
| Political Science (550) | 0.08 |
| Sociology (551) | 0.58 |
| Social Sciences, Other, General (541, 560) | 0.65 |
| Other (includes missing) | 0.63 |

education have degrees in * Also includes: 610 (Construction Trades) & 662 (Precision Production)

economics.⁴ Nonetheless, economic ideas do find their way into education journals, just not as quickly as is the case with psychology and sociology.

The term “human capital” was coined by economists during the 1950s to emphasize the economics aspects of educational decisions. In this regard, “investing” in human capital is analogous to investments in physical capital, ie., factories and equipment. While some critics complain that the human capital perspective is too narrow in emphasizing only the economic aspects of education, over time the human capital school has made a powerful case for additional investments in education and the expansion of educational opportunities.

Figures 11a and 11b chart the number of academic journal articles on the topic of human capital in three fields: economics, sociology and education. Publications on this topic naturally appear first in economics journals, since economists coined the term and developed this framework. By 1975, roughly 15 articles in academic journals in economics were appearing annually on this topic. While a few papers were published annually in this area in education during the 1970s and 1990s, it is not until 1995 that a sustained increase in new articles on this topic appear in education journals. This rise in education journal articles coincides with a jump in the number of journal articles appearing in sociology, and is roughly five years after a major spike in articles in economics journals. The logged results in Figure 11b indicate that the rate of increase actually begins in 1990 in sociology and education.

⁴ This tabulation was based on the National Survey of Post-secondary Faculty. To obtain this result, the doctoral degree field of study for those with current teaching position in education were tabulated. Sarah Winslow was kind enough to provide this tabulation.

Figure 11a. Human Capital: Diffusion into Education and Sociology

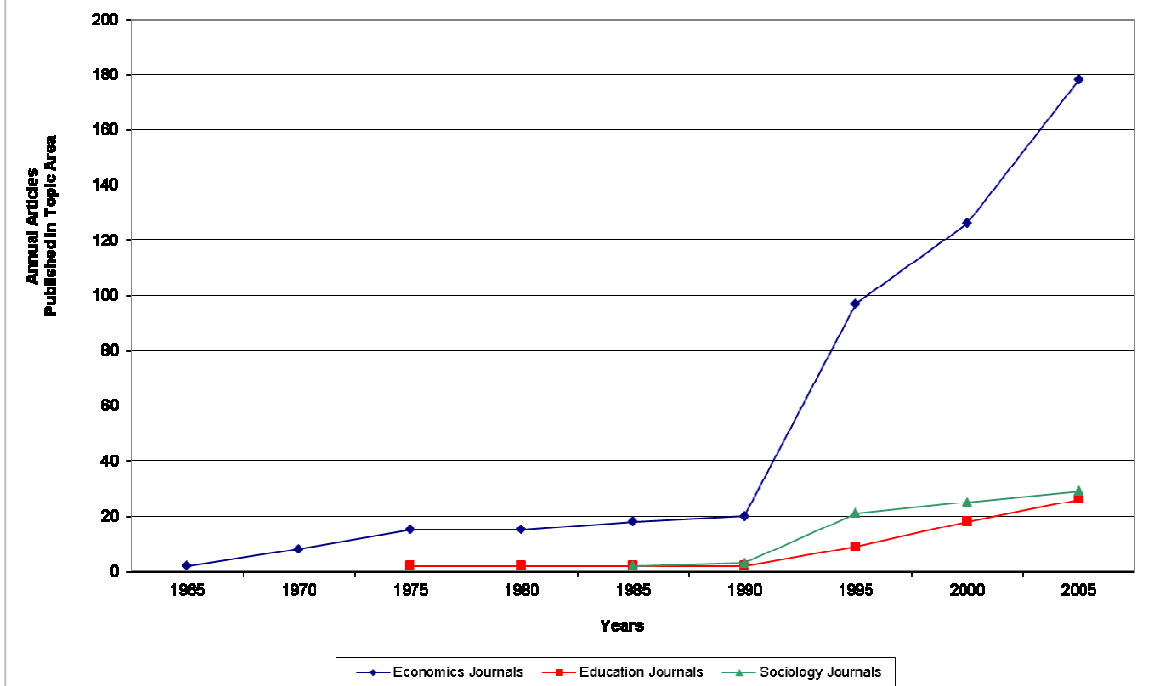
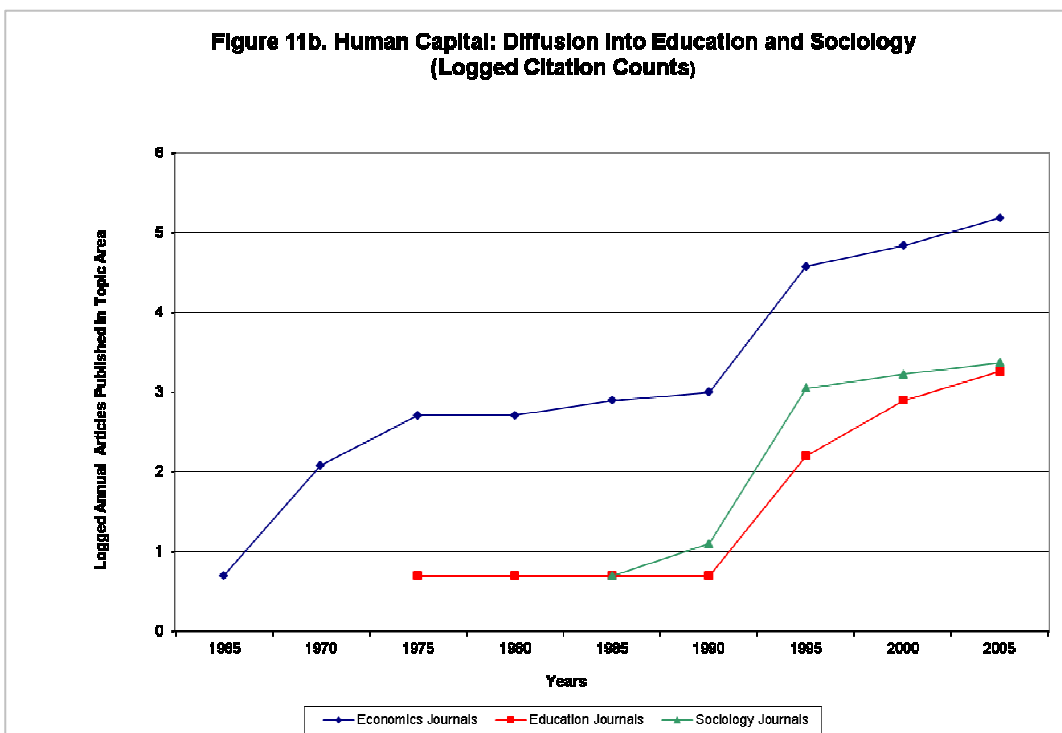


Figure 11b. Human Capital: Diffusion into Education and Sociology (Logged Citation Counts)



The results presented in Figures 11a and 11b suggest that education has indeed lagged considerably behind economics in journal articles in the area of human capital.

Specifically, a sustained increase in education journal articles published on this topic does not begin until 1995, approximately 30 years after economics articles began to be published on this topic. While education scholars may have lagged behind economists, they picked up the human capital thread somewhat earlier than their colleagues in sociology.

This conclusion is modified somewhat when the focus shifts from journal article topics to the citation of particular papers. Figure 12 focuses on citations to one prominent contribution in the area of human capital, Gary Becker's book by the same name. This figure shows that articles in education journals were citing Gary Becker's book, *Human Capital*, in considerable numbers as early as 1973, and were a bit quicker to do so than were their counterparts in sociology. By the end of the 1970s, citations to Becker's work in sociology began to slightly outpace those in education. Thus, educationists were aware of the human capital perspective and were citing it quite frequently from the 1970s onward, even if they were not publishing papers in this area until later.

Taken together, these results suggest that economics is a field where educationists lag somewhat behind, although we should be clear that the lag is relatively modest in duration given the scarcity of economists in schools of education in a position to receive these ideas.

It is hard to get a comprehensive view of the place of statistics in contemporary education scholarship. There are many contributors in this area whose scholarship may be cited and many statistical methods that are employed. We start with some prominent scholars and then branch out to trace the diffusion of several specific methods. A simple summary of these patterns is that educational researchers have quickly adopted a range of new statistical techniques. On the basis of these patterns, it seems hard to level the charge that educationists have been impervious to new statistical developments.

We begin our investigation in this area with Jacob Cohen, whose 1977 book *Statistical Power Analysis for the Social Sciences* appears on Walters and Lareau's list of the most cited sources in education. Cohen's work has also been widely employed by psychologists and researchers in many fields. Our question is whether the reception of this work was unduly delayed in education compared with companion fields.

Figure 13 shows that, within five years of its publication, Cohen's work was cited 20 or more times annually in education journals. In the ensuing decades, this volume continues to be referenced nearly as often. In psychology journals, Cohen's book continued to grow in influence for nearly 30 years after publication, reaching a peak of 130 citations in 2004. The initial reception curve is rapid in both education and psychology, but it quickly flattens out for education which continuing a long ascent in psychology.

The term "structural equations" has appeared as a topic over 16,000 in academic journals articles across a wide variety of disciplines, and 238 times in education journal articles. Was education quick or slow in assimilating research using structural equations? Figure 14 compares the incidence of this term in education and social

psychology since 1991. Research using structural equations diffused more rapidly into social psychology than it did into education, but the difference is not that great.

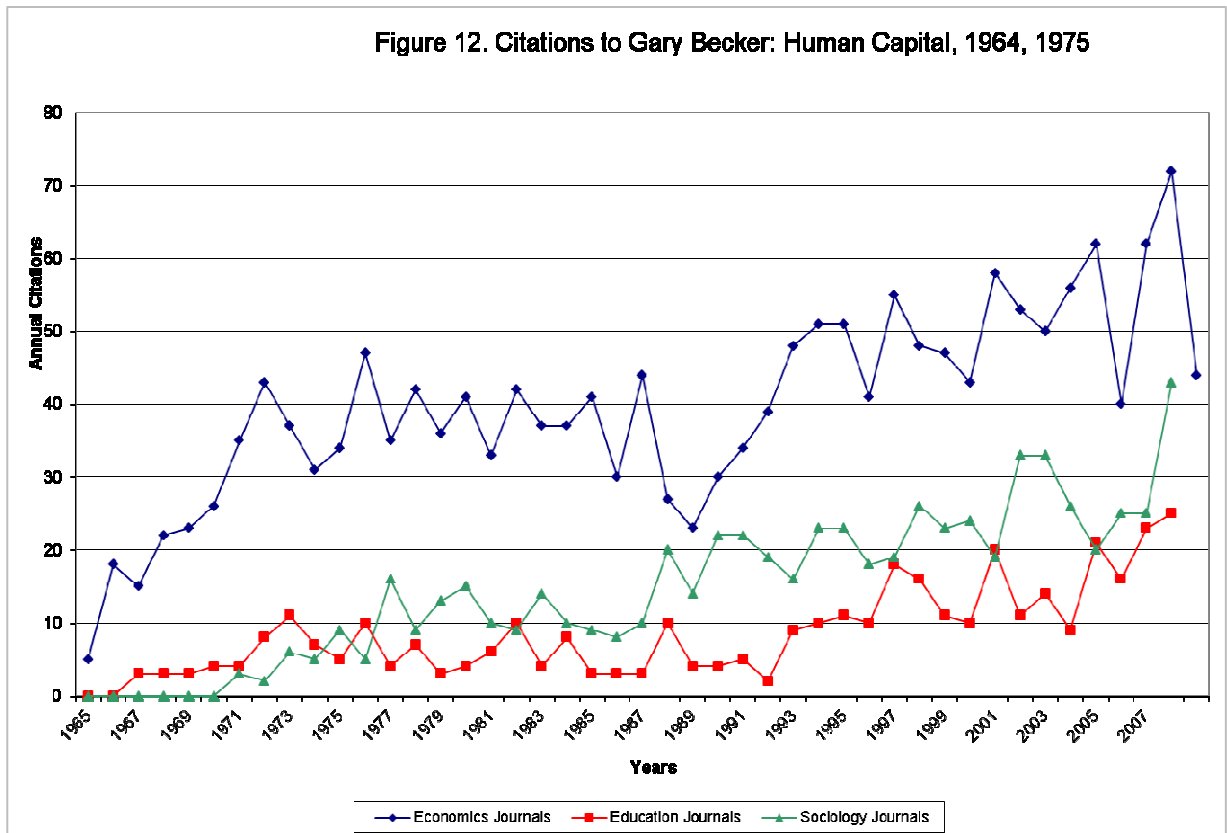
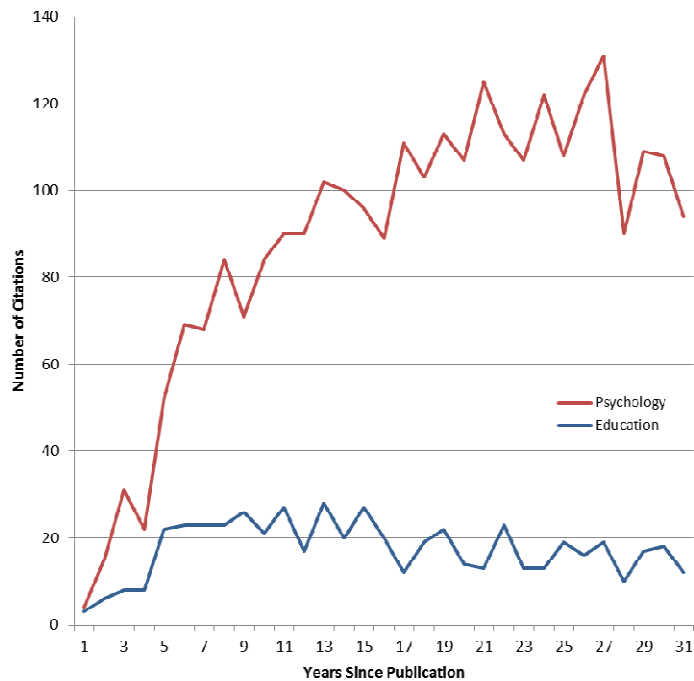


Figure 13 Annual Citations for Statistical Power Analysis of the Behavioral Sciences (J. Cohen, 1969)



Another way to consider the relative position of education is to compare adoption of this technique in education with those in all other fields. Since the scales are so different, graphing education versus all other fields on the same figure would be difficult to see. I examined the percent of all uses occurring in a given year, thus putting both groups in the same percentage metric (results not shown). Viewed this way, education is indeed a bit behind other fields, reflecting the same pattern evident in Figure 14 in that its usage is relatively low in the earlier 1990s. The example of research articles in the area of structural equations is thus an example that shows education to be somewhat behind the adoption rate of social psychology in particular and other fields in general.

A second example, hierarchical linear models (HLM), was adopted by education researchers with an even shorter delay. It may be that the location of the inventor of this technique in a school of education facilitated its adoption by educationists. Stephen Raudenbush and Anthony Bryk, both of whom earned their degrees in educational statistics at Harvard, held faculty positions in schools of education. Sustained citations to HLM first appear in the Web of Knowledge in 1991 and begin their upward ascent in education in 1993 (Raudenbush and Bryk 1986; Bryk and Raudenbush 1992). Since then the use of this technique has grown in parallel between education and other fields.

Meta-analysis is another homegrown statistical approach diffused rapidly in the field of education. Larry Hedges, who played a prominent role in inventing meta-analysis, obtained his degree in educational statistics from Stanford and held a faculty position in the University of Chicago School Education for many years. Meta-analysis combines the results of a group of small studies into a single statistical analysis, giving researchers more statistical power by combining many relatively small individual studies into a single, larger statistical generalization (Hedges and Olkin 1992). Meta-analysis has been used in some fifty thousand academic articles over the last thirty years in fields from the medical sciences to psychology, nearly four hundred (391) of which have appeared in education journals.

Figure 15 shows that educational researchers were relatively early adopters of this technique. During the 1980s, when meta-analysis was relatively new, education scholars were conducting a number of studies using this technique. Over time, its popularity has soared, while its use in education has remained relatively constant. Thus, if educationists were somewhat slower than other researchers to employ structural equations in this research, they appear to have been a bit faster to adopt meta-analysis.

Overall, the past 40 years has seen a range of statistical techniques flow into educational scholarship. In some cases, educationists are a few years behind others disciplines in adopting these techniques, but in other cases they are somewhat ahead of the curve. Here again, it is hard to square the view of education as an isolated silo with these data on the broad-based adoption of a range of statistical research techniques by scholars publishing in education journals.

Figure 14: Structural Equations -- Percent of Citations by Year

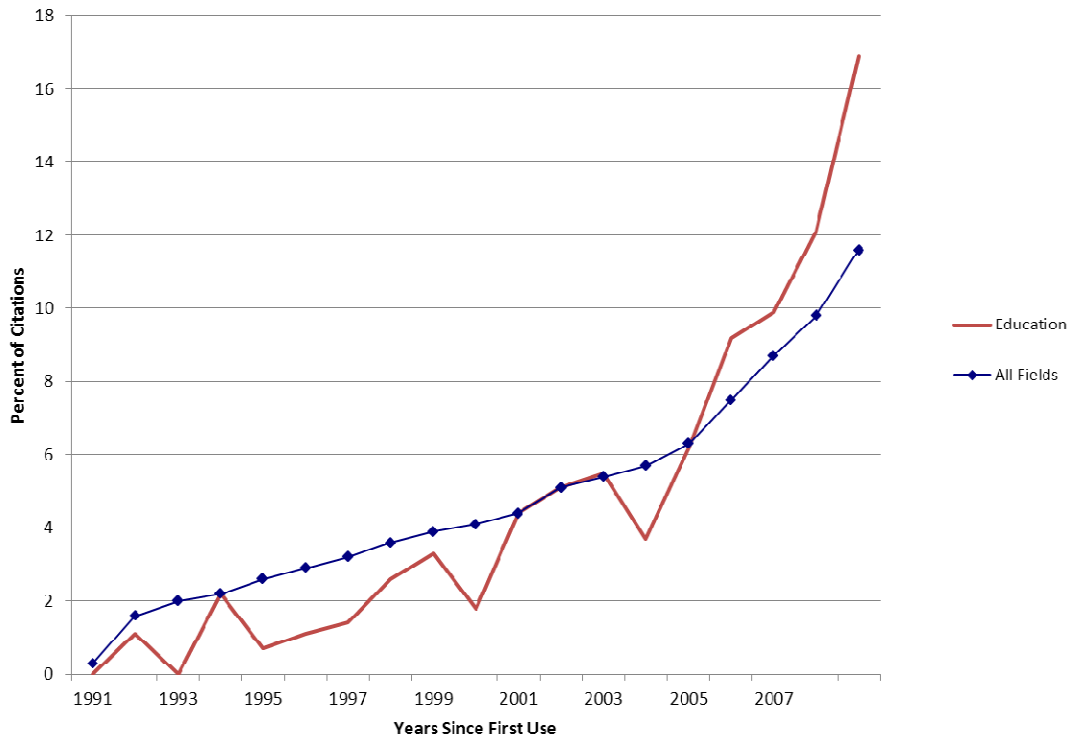
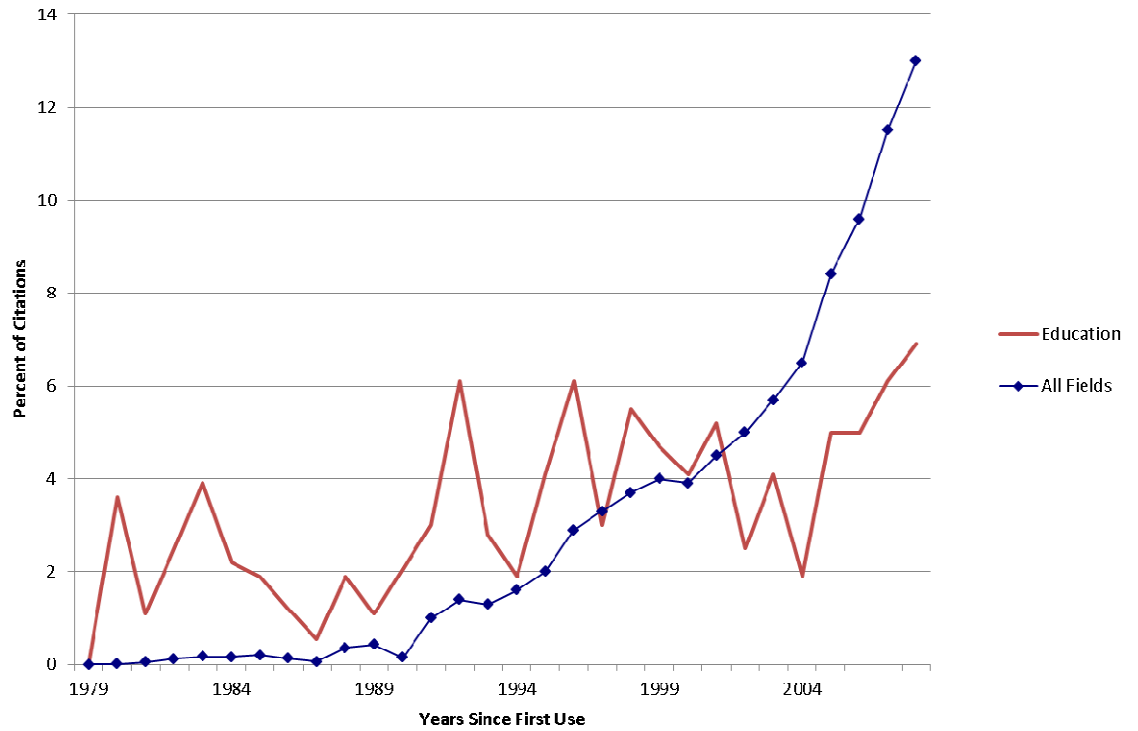


Figure 15: Meta-analysis: Percent of Articles Published on Topic by Year



5. Receptivity to Broad Intellectual Trends

In tracing intellectual influences, thus far we have taken pains to carefully identify the intellectual content in question. We have examined citations to a number of specific authors whose work was published at specific times, and we have considered the diffusion of technical terms where the meaning of these terms is likely to show a great deal of consistency. Another type of intellectual trend is more atmospheric: there are terms whose origins are harder to pin down and whose meaning may vary from author to author. The imprecise nature of these intellectual trends should not keep us considering what their patterns of movement may look like. Is the field of education open to broader currents that traverse across academic disciplines?

Globalization

The topic of “globalization” represents an interesting case in that it is not a simple matter of diffusion from one discipline to another. Researchers have studied examined many aspects of the international scene for many years. The globalization of

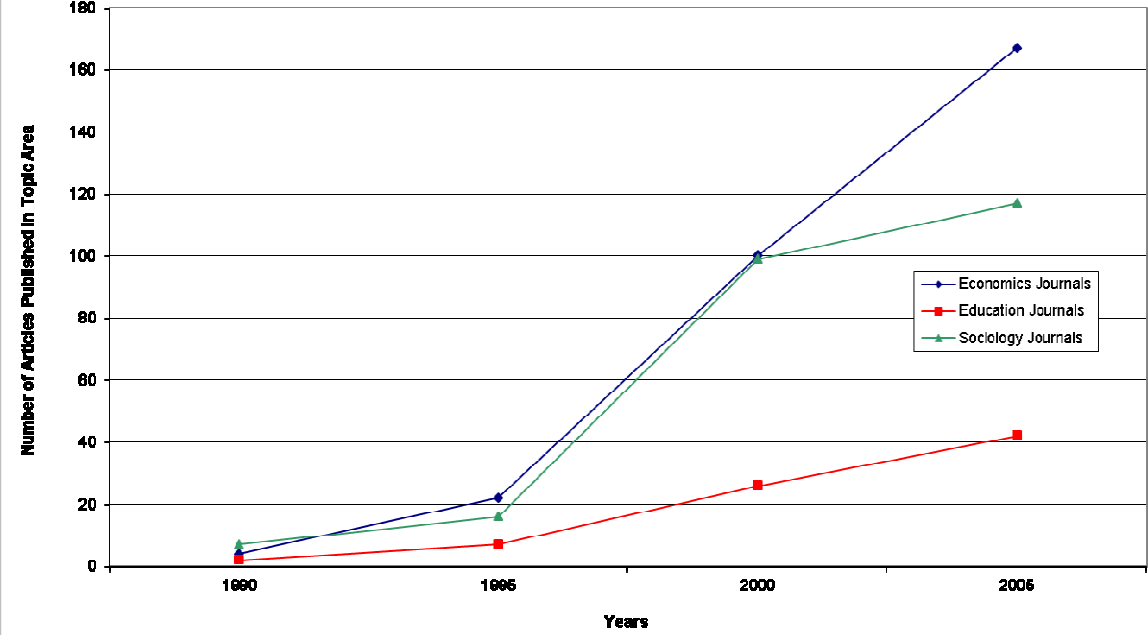
the economic system has been a concern for economists dating back to Adam Smith and Karl Marx, and sociologists, political scientists and others have been writing about “modernization” and its effects across the globe since the 1950s.

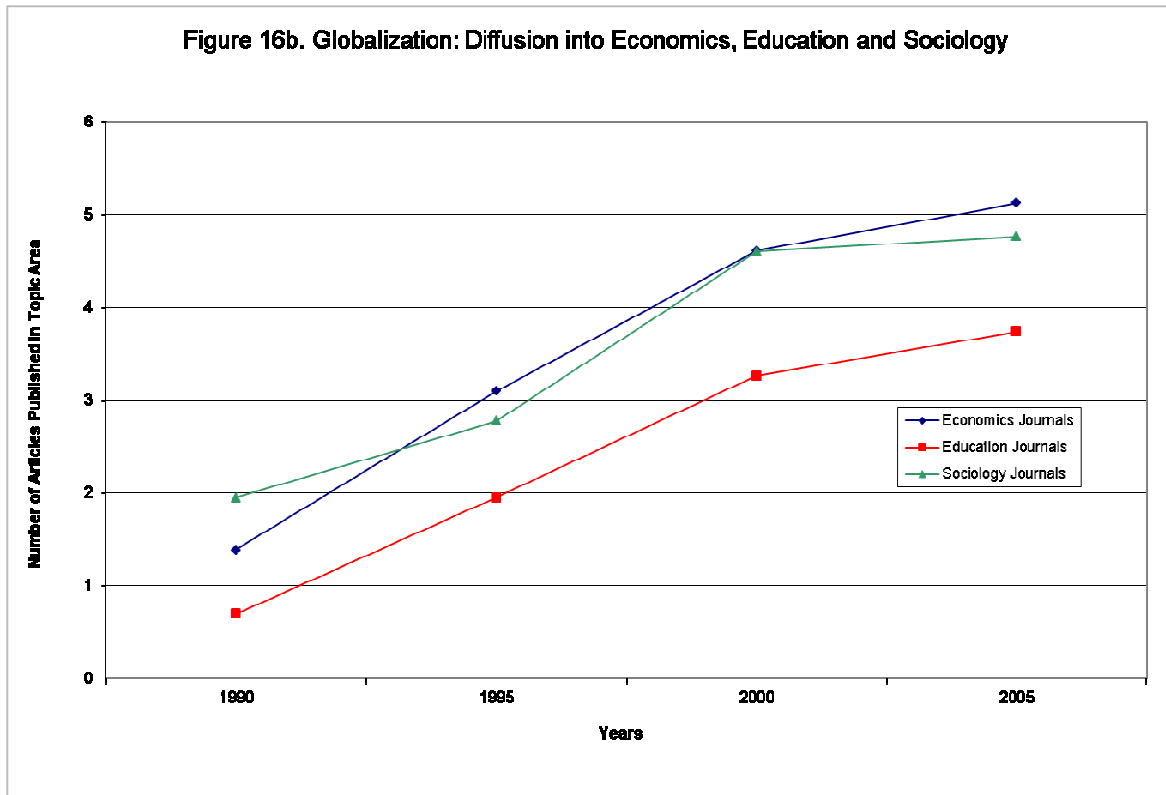
More contemporary writers and researchers have employed the term “globalization” to refer to the trend towards greater economic, social, cultural and political integration across the disparate elements of the social world. The term “globalization” is often used in economics and sociology but it is not tightly linked with these fields: one may use the term to mean a wide variety of things, and apply it in a wide variety of ways. In this regard, it is quite different from terms such as “human capital” or techniques such as “meta-analysis.”

Figure 16a tracks the prevalence of articles in the topic area of “globalization” in academic journals in the fields of economics, sociology and education. The term begins to come into use around 1990, none of the three disciplinary areas had as many as 10 articles per year indexed with this term. By, 1995, the term globalization begins to be more common in economics and sociology than in education, and by 2000 the gap is much more pronounced. The term continues to become more common through 2005. The rate of growth slows down in sociology but increases in education.

Does the term globalization fit the delayed diffusion pattern highlighted in Figure 1? While globalization is a hotter topic in economics and sociology, the rate of growth in its prevalence as a topic is generally similar in the three fields. Figure 16b presents the natural log of the prevalence of this term in the three fields. While economics and sociology track each other quite closely since 1990, the rate of growth in education seems quite similar to these other fields. Thus, the gaps evident in Figure 16a can be viewed as disparities in the size of the fields, or the number of scholars working on this topic, rather than evidence of a delay in focus on this area of scholarship.

Figure 16a. Globalization: Diffusion into Economics, Education and Sociology





Post-Modern

Thus far we have focused on the flows of ideas between education and closely related fields such as psychology, sociology and economics. What of the humanities? Is literary theory too far removed intellectually and socially from education for its concepts to percolate into education journals?

The term “post-modern” proves to be a useful example because it is one of the few cases examined where citation rates decline substantially after a peak point is reached. This enables us to consider the prolonged allegiance aspect of the reception curve, that is, the right-side of the graph laid out in Figure 1.

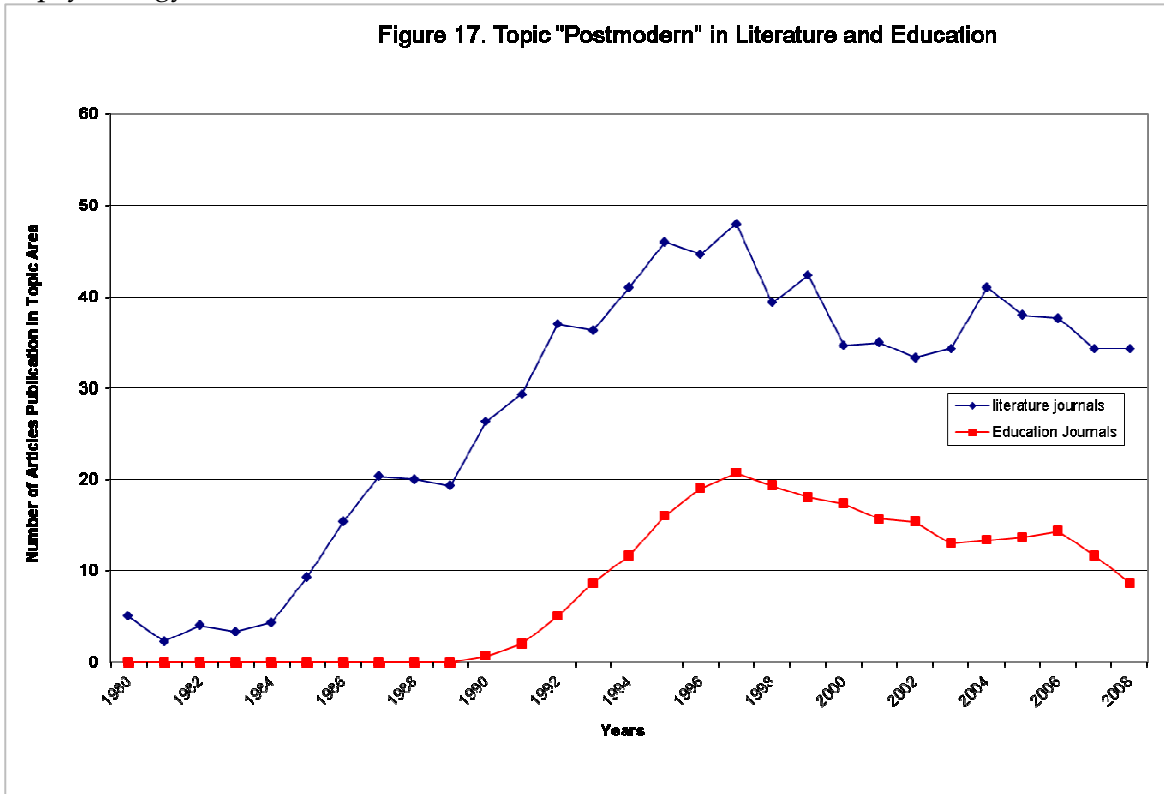
Figure 17 traces the frequency with which the term “post-modern” appears in journals in literature and in education. The post-modern trajectory reveals that, while this term was relatively slow to seep into education journals, the decline in its use in education journals coincides with the decline in literature journals. Thus, this case does not support the notion that educationist are slow to turn away from outdated ideas.

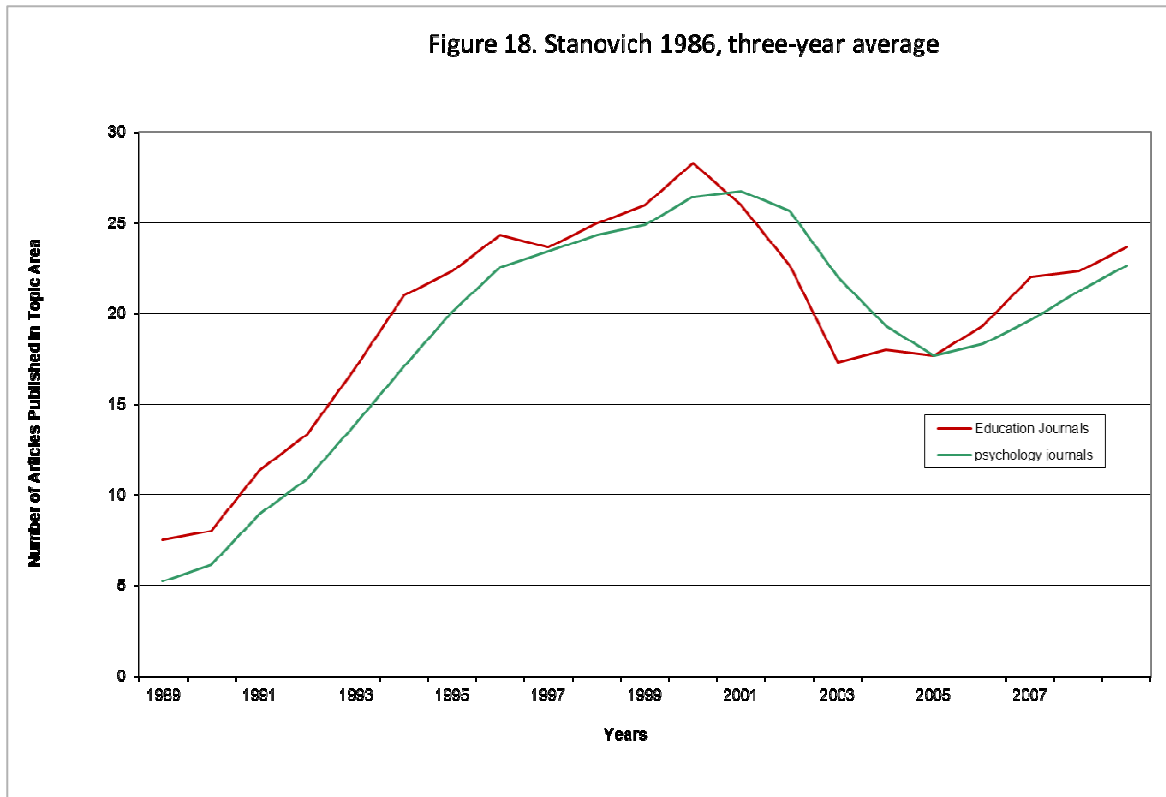
6. Exporting Educational Research

In considering the question of the intellectual isolation of schools of education, it is important to remember that ideas can flow two ways. Thus far we have examined the extent to which ideas flow into education. Let us now consider flows in the opposite direction. How well does the research of education scholars travel?

Stanovich’s 1986 paper on reading is one of most cited papers in education journals since 1980. Did scholars outside of education discover this paper? Figure 18

shows that the reception of Stanovich's work in education and psychology are roughly parallel over the 20 years since this paper was published. In this case, research published in an education journal was successful in becoming recognized in the disciplinary field of psychology.



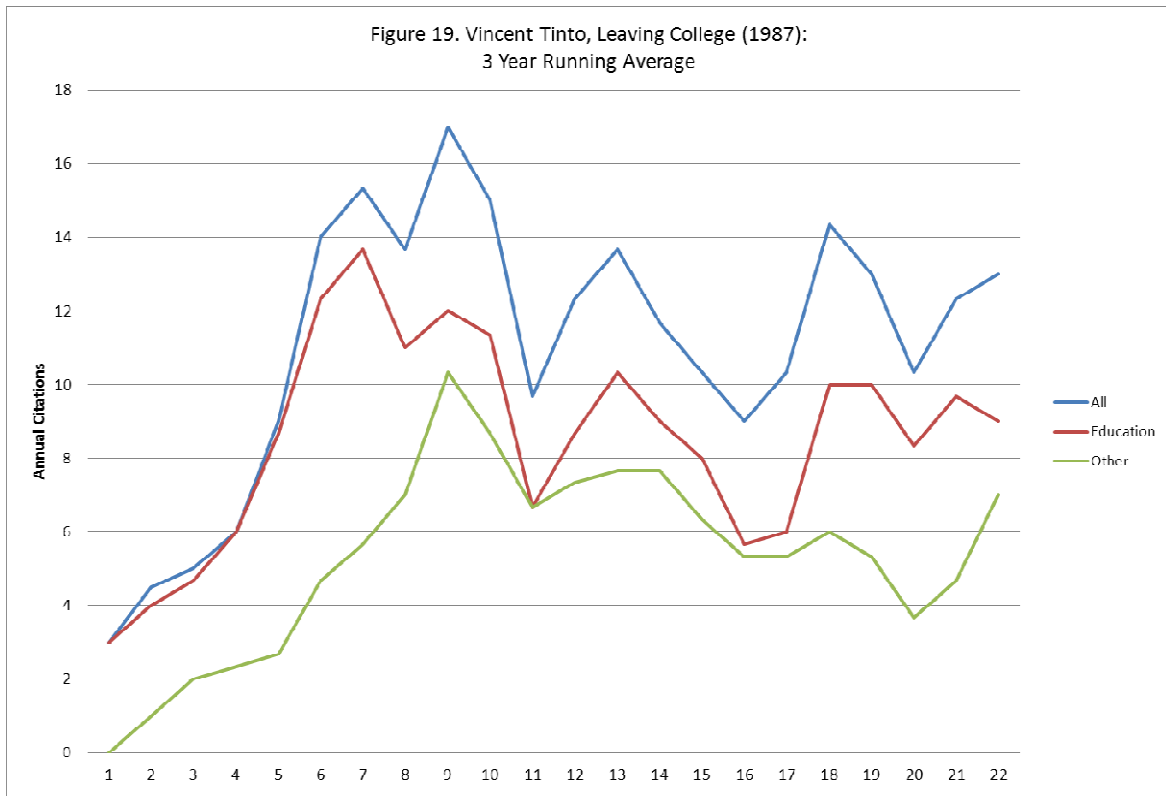


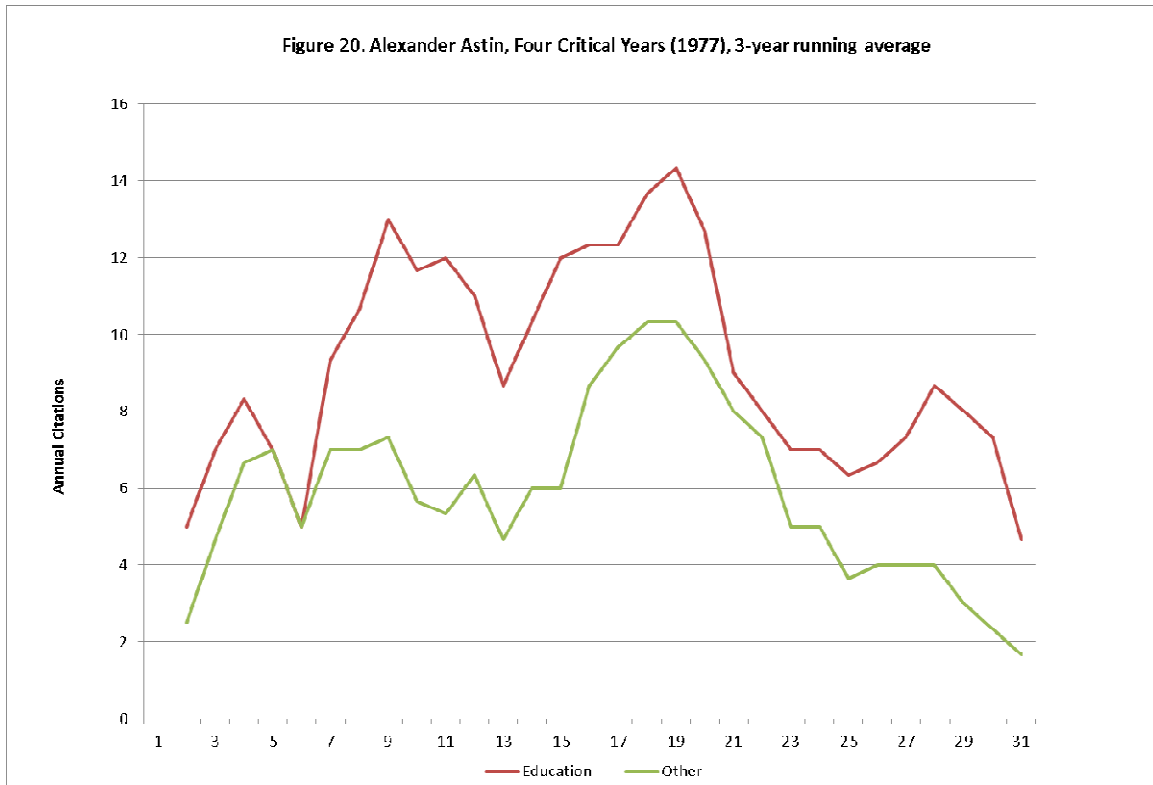
Vincent Tinto is a social psychologist who specializes in issues of higher education. His work on the adjustment to college has been influential among students of the college experience. In Figures 19a and 19b, we examine the influence of his influential review essay, written in 1975, and his book on who leaves college, published in 1987. We compare citations to these two publications in education journals to those in all other fields.

Tinto’s scholarship has been more visible in education than in other fields, but these two figures clearly indicate that, in terms of timing and trajectory, the reception of his work is similar outside of education. Tinto’s 1987 book reached its peak visibility a decade after its publication, but has continued to be cited more than 10 times per year since that time. Citations were more initially more frequent in education than in other fields, but the peak citation year is the same for education and for other fields, and in general these two curves largely move in tandem with each other.

The graph in Figure 19b for Tinto’s 1975 essay on “dropout from higher education” has a few interesting wrinkles. First, there are more citations to this essay in education journals than elsewhere. Second, the initial peak in influence is the same (11 years), as is the lowest point of influence (year 28). Third, there is a resurgence in interest in Tinto’s essay starting 28 years after publication in both education journals and elsewhere. While the annual number of citations often fluctuates from year to year, it is relatively unusual to see a sustained resurgence of interest in a paper as in this case.

Again, the timing of this renewed interest is identical in education journals and other venues.





Alexander Astin of UCLA has directed a large-scale data collection project on college freshmen since the late 1960s. The media often cite the results of this project when discussing trends in the experiences of college students. Astin's most influential research has involved the studies that follow freshmen through their years in college. Figure 20 graphs the reception of Astin's 1977 book, *Four Critical Years*. The smoothed results show an initial peak in interest about 10 years after publication, followed by a second peak about 20 years later. There are more references to this work in education journals than in journals in other fields. The receptivity curves in education and other fields resemble each other, but there is more continuity in interest in education than in other fields.

In order to explore the flow of ideas from education to other fields, I drew on Rinia et al.'s approach by comparing the timing of the inter-disciplinary citations with those occurring within the same discipline. While it may be hard to know whether psychologists should be citing educationists, we can at least see if they are relatively late in learning about and citing educational scholarship.

Table 3 examines the citations to ten journals, seven in education and three in educational psychology. All articles published between 1990 and 2000 were examined. The question is whether citations occurring in education journals appear earlier or later than those in other fields. The first conclusion that can be reached from the set of journals examined in Table 3 is that the lag in reception was typically less than one year. In three of the ten cases, the lag is more than one year but less than two years. Given the long lag times in publication and the long time frame for the influence of important

studies, this seems like a relatively minor difference. In other words, ideas generally flow from education to other fields with only a minor (less than one year) delay. In eight of the ten journals, educationists cited the material faster than did researchers in other fields. In the case of two journals, both in educational psychology, educationists cited the research later than did scholars in other fields.

Four generalist journals in education were examined. For each of these journals, education scholars cited the research a bit more quickly than did researchers in other fields, but the gap was less than one year.

| Table 3. Journal Citations | | | | | | | | | |
|---------------------------------------|------------|------------|------------|----------------------|----------|---------------------------------|--------------------|-------------------|--------|
| A. Generalist Journals | | | | | | | | | |
| | Time Frame | One Year | Five Year | Median Citation Year | | Difference | % Citations in | median time | |
| | | Impact | Impact | Education | Other | In Years | Education Journals | after publication | |
| | | Factor | Factor | Journals | Journals | (+ = ed journals faster) | | | |
| Review of Education Research | 1990-2000 | 3.361 (1) | 4.803 (1) | 2002.069 | 2000.358 | 0.289 | 55.11% | 6.569 | 4.858 |
| American Educational Research Journal | 1990-2000 | 1.667(9) | 2.874 (3) | 2001.236 | 2001.996 | 0.760 | 52.58% | 5.736 | 6.496 |
| Journal of Higher Education | 1990-2000 | 1.250 (20) | 1.378 (26) | 2002.349 | 2002.952 | 0.603 | 63.22% | 6.849 | 7.452 |
| Harvard Education Review | 1990-2000 | 0.619 (65) | 1.176 (34) | 2005.970 | 2006.083 | 0.113 | 60.26% | 10.470 | 10.583 |
| B. Education Psychology Journals | | | | | | | | | |
| Child Development | 1990-2000 | 3.821 | 5.543 | 2005.664 | 2004.549 | -1.115 | 3.78% | 10.164 | 9.049 |
| Journal of Learning Sciences | 1990-2000 | 2.433 | 4.060 | 2003.569 | 2003.031 | -0.538 | 50.11% | 8.069 | 7.531 |
| Journal of Counseling Psychology | 1990-2000 | 2.108 | 3.289 | 2000.002 | 2002.162 | 0.160 | 4.64% | 4.502 | 6.662 |
| C. Specialized Education Journals | | | | | | | | | |
| Health Education Research | 1990-2000 | 2.310 (5) | 2.776 (5) | 2001.354 | 2003.272 | 1.918 | 9.66% | 5.854 | 7.772 |
| Computers and Education | 1990-2000 | 2.190 (6) | 2.712 (6) | 2001.432 | 2002.336 | 0.904 | 53.14% | 5.932 | 6.836 |
| Sociology of Education | 1990-2000 | 1.594 (11) | 2.265 (9) | 2002.327 | 2003.357 | 1.030 | 37.51% | 6.827 | 7.857 |

Three of the journals were specialized education journals: *Health Education Research*, *Computers and Education*, and *Sociology of Education*. One might have thought that health scholars would cite research on health education faster than would education scholars, but this is not the case. Similarly, one might have thought that sociologists would cite articles in the journal *Sociology of Education* faster than would education scholars, especially since this journal is edited by sociologists and is sponsored by the American Sociological Association, but again this is not the case.

The data presented in Table 3 confirm the general pattern of findings we obtained earlier from tracing the reception trajectories of individual papers. Broadly speaking, it takes less than a year on average for education scholarship to travel outside of the discipline compared to the time it takes the same research to be recognized within education journals.

7. Summary

Despite concerns raised about the intellectual isolation of schools of education, the evidence compiled here suggests that ideas generated elsewhere are rapidly assimilated by educational researchers. Ideas flow easily from psychology into education, and the same can be said for sociology and statistics. Economics is probably the clearest case where there is a lag between the development of new ideas and their reception in education, but even here the lag is not as long as one might think and depends on whether the lag is measured in terms of citations or journal article titles.

The evidence for movement from education to the broader academic community is perhaps more mixed. Research by prominent educationists, as well as research published in education journals, does travel to other fields, although in most cases the majority of citations are limited to other scholars of education.

The thrust of this analysis suggests that disciplinary “silos” are not nearly as limiting as some critics of disciplines and some advocates of interdisciplinarity have suggested. The field of education has not been unduly hampered by its intellectual and social distance from the rest of the academy. Interdisciplinarity may be a good idea, but the claim that interdisciplinarity is needed to overcome disciplinary myopia is not well supported by the receptivity trajectories presented here. Whether the focus is on individual papers, specific technical terms, or broad concepts, scholars in the fields of education are quick to assimilate ideas developed in related disciplines. The movement of ideas in the opposite direction may not be as extensive, but here again there is little evidence of a time lag. Citations to articles published in education journals occur at roughly the same time in other fields as they do in education.

The accumulated data from a variety of distinct approaches, taken together, suggest that the field of education should be absolved from the charge of being a remote field of scholarship.

REFERENCES

- Astin, Alexander W. 1977. *Four Critical Years*. San Francisco: Jossey-Bass.
- Bandura, Albert, ed. 1995. *Self Efficacy in Changing Societies*. Cambridge: Cambridge University Press.
- Becker, Gary. 1964. *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*. New York: National Bureau of Economic Research, distributed by Columbia University Press.
- Bourdieu, Pierre, and Jean-Claude Passeron. 1977. *Reproduction in Education, culture and Society*. Translated by Richard Nice. London: Sage Publications.
- Brouthers, Keith D., Ran Mudambi, and David M. Reed. 2012. "The Blockbuster Hypothesis: Influencing the Boundaries of Knowledge." *Scientometrics* 90:959–82.
- Bryk, Anthony S., and Stephen W. Raudenbush. 1992. *Hierarchical Linear Models: Applications and Data Analysis Methods*. Newbury Park, CA: Sage.
- Cohen, Jacob. 1977. *Statistical Power Analysis for the Social Sciences*. New York: Academic Press.
- Coleman, James. 1966. *Equality of Educational Opportunity*. Washington, DC: US Department of Health, Education, and Welfare, Office of Education.
- Coleman, James. 1988. "Social Capital in the Creation of Human Capital." *American Journal of Sociology* 94 (Supplement): S94-S120.
- Geiger, Roger L. and Creso Sa. 2008. Tapping the Riches of Science. Cambridge, MA: Harvard University Press.
- Hedges, Larry V., and Ingram Olkin. 1992. *Statistical Methods of Meta-Analysis*. Orlando, FL: Academic Press.
- Jacobs, Jerry A. 2009. "Where Credit is Due: Assessing the Visibility of Articles Published in Gender & Society with Google Scholar." *Gender & Society*: 23(6):817-832

- Jacobs, Jerry A. and Scott Frickel. 2009. "Interdisciplinarity: A Skeptical View." *Annual Review of Sociology* 35:43-65.
- Labaree, David F. 2004. *The Trouble with Ed Schools*. New Haven, CT: Yale University Press.
- Lagemann, Ellen C. 2000. *An Elusive Science: The Troubling History of Education Research*. Chicago, IL: University of Chicago Press.
- Piaget, Jean. 1952a. *The Origins of Intelligence in Children*. New York: International Universities Press.
- Piaget, Jean. 1952b. *Play, Dreams and Imitation in Childhood*. Translated by C. Gattegno and F. M. Hodgson. New York: Norton.
- Piaget, Jean. 1954. *The Construction of Reality in the Child*. Translated by Margaret Cook. New York: Basic Books.
- Raudenbush, Stephen W., and Anthony S. Bryk. 1986. "A Hierarchical Model for Studying School Effects." *Sociology of Education* 59:1-17.
- Rinia EJ, Van Leeuwen TN, Bruins EW, Van Vuren HG, Van Raan AFJ, et al. 2001. Citation delay in interdisciplinary knowledge exchange. *Scientometrics* 51(1):293-309
- Stanovich, Keith. 1986. "Matthew Effects in Reading: Some Consequences of Individual Differences in the Acquisition of Literacy." *Reading Research Quarterly* 21(4):360-407.
- Tinto, Vincent. 1975. "Dropout from Higher Education: A Theoretical Synthesis of Recent Research." *Review of Educational Research* 45:89-125.
- Walters, Pamela B., Annette Lareau and Sheri H. Ranis, eds. 2009. *Education Research on Trial: Policy Reform and the Call for Scientific Rigor*. New York, NY: Routledge.
- Wechsler, David. 1991. *WISC-III: Wechsler intelligence scale for children*. San Antonio, TX: Psychological Corporation, Harcourt Brace Jovanovich.

US Department of Education. National Center for Education Statistics. 2011. National Survey of Postsecondary Faculty: Overview. <http://nces.ed.gov/surveys/nsopf>