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On the Science of Learning: Herbert J. Walberg Examines the Literature of Educational Psychology

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In the last year or so, in addition to our regular citation studies, we have presented a selection of guest essays featuring citation-based analyses of various disciplines. For example, in a two-part study, economist Arthur M. Diamond, University of Nebraska, Omaha, examined the core journals of economics, as well as the field's most-cited papers and current research fronts.^{1,2} And last spring, as part of our series of journal citation studies, Elizabeth Fuseler-McDowell, then ISI®'s manager of bibliographic research, discussed the literature of marine biology.³

In this essay we are pleased to introduce Herbert J. Walberg, Department of Educational Psychology, University of Illinois, Chicago. In the following pages, he examines the key literature in his own discipline: educational psychology. After defining the field and briefly surveying its historical development and major practitioners, he goes on to highlight core journals, most-cited papers, and research fronts.

Walberg points out that educational psychology has grown in visibility and importance over the last 30 years, as policymakers have recognized that knowledge and skills are, in his words, "keys to the wealth and welfare in modern societies." In the US there has been particular concern regarding the decline in math and science aptitude on the part of our young people. This problem has been discussed previously in these pages—most recently last year, when I reprinted my paper, "Long-term strategies for

improving science education."⁴ That piece was based on a talk I'd given at a conference on science and technology education sponsored by the American Medical Association. Just a few months ago, I attended a breakfast meeting organized by the New York Academy of Sciences. The keynote speaker, Bill G. Aldridge, executive director, National Science Teachers Association, Washington, DC, outlined a plan for reforming secondary-school science education. Aldridge has lectured and written extensively on this topic.⁵

Of course, a massive national effort at educational reform requires, at the very least, a detailed understanding of how children learn, as well as reliable information on how changes in organization and curricula can be designed and put to the most effective use. These topics, as Walberg points out, are central to educational psychology. This lends particular relevance to his overview.

Walberg's analysis readily conveys the breadth of topics that educational psychology encompasses. His discussion of most-cited articles, for example, touches on the variety of cognitive, emotive, sociological, and even geographical issues that arise in creating and evaluating curricula and study methods.

Walberg is a psychologist and research professor of education at the University of Illinois. He has written or edited more than 35 books and contributed more than 300 articles to educational and psychological journals on such topics as science and mathe-



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mathematics education, giftedness and talent development, educational productivity and statistics, international comparisons of achievement, instructional psychology, and citation analysis.

Formerly assistant professor at Harvard University, Cambridge, Massachusetts,

Walberg has served as an advisor on educational research and improvement to governmental and private agencies in the US and a dozen other countries. He currently chairs the Scientific Committee for Comparative Educational Indicators for the Paris-based Organization for Economic Cooperation and Development. He also chairs the Technical Methodology Committee of the National Assessment Governing Board, which has been given the responsibility by the US Congress for setting subject matter achievement goals for American students.

Walberg is currently preparing another article for these pages that promises to have even more pertinence to the educational dilemma in the US: a citation analysis of the literature of mathematics and science education. We look forward to that study. For now, however, we are pleased to present Walberg's analysis of the literature of educational psychology.

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Educational Psychology: Core Journals, Research Fronts, and Highly Cited Papers

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Educational psychology is introduced and defined, and a historical background is provided. A list of core educational psychology journals is analyzed, along with journals citing and cited by this core. Pertinent research fronts include those dealing with reading comprehension, initiatives for special students, and educational policy. Also examined is a selection of most-cited articles, including papers examining various sociological factors and their effects on learning. Educational psychology is shown to straddle the two disciplines implied in its name.

Educational Psychology Defined

Educational psychology may be defined by its two chief purposes—identifying psychological problems within educational settings and applying psychological principles to solve problems. Its major fields of investigation and application are standard topics in general psychology, including (1) behavior, thinking, and motivation; (2) individual differences, development, and learning; (3) heredity and environment; and (4) the measurement and analysis of human characteristics and behavior.

Many educational psychologists are professors in departments of education or psychology, where they conduct research and teach prospective educators. Other educational psychologists work in corporations, industry, the military, government, and private practice where they design and assess educational programs. Closely related to educational psychology are the fields of educational evaluation and testing; educational guidance and counseling; and school psychology, which provides educational services such as diagnosis and remediation of learning difficulties.

Development of the Field

The major civilizations of the world have attempted to pass on their knowledge, skills, and heritage from one generation to the next. Since ancient times the family served this purpose; other educational institutions, how-

ever, particularly schools and universities, have taken on greater and more specialized responsibility for education during the centuries.

In the late nineteenth and early twentieth centuries, several eminent American psychologists contributed to educational psychology. William James (1842-1910) made psychology an acceptable academic discipline independent of philosophy. Habit was central to his views, although he also emphasized the mind as active, spontaneous, and selective. His popular *Talks to Teachers on Psychology and to Students on Some of Life's Ideals* began the application of scientific psychology to educational problems.¹

A Harvard University student of James, Edward L. Thorndike (1874-1949), carried out extensive research at Teachers College, Columbia University, New York, and is usually acknowledged as the prolific father of educational psychology. He emphasized the effect of rewards on learning, pioneered research on adult learning, and developed teaching methods and materials for the standard school subjects. Thorndike also introduced statistical methods into education and psychology and developed objective achievement tests and other educational measures.

Educational psychology grew in policy influence during the twentieth century. Since about 1960 policymakers have increasingly recognized knowledge and skills as keys to wealth and welfare in modern societies. The 1983 National Commission on Excel-

lence in Education report, *A Nation at Risk: The Imperative for Educational Reform*,² revealed to the public US students' poor performance on achievement tests in mathematics and science by international standards. The subsequent educational reform movement intensified the search for better organizational arrangements, curricula, methods of teaching, and how they may be encouraged and implemented—all central topics of educational psychology.

In an effort to enlarge learning, education has been extended below the traditional kindergarten to preschools to give children a better start. It has also been extended beyond secondary school and college since lifelong learning is required by many of the new knowledge-intensive occupations. Educational psychologists have designed and evaluated new educational programs for students from infancy through old age and also for nontraditional educational settings such as corporations and the military.

Educational psychologists have worked in a variety of substantive fields. They may be found in many academic and professional departments of universities designing educational media and examinations, consulting with departments on new means of teaching—such as computer-based instruction—and doing research on fundamental processes of learning that extend or transcend academic and professional disciplines.

Previous Citation Analyses

Publication and citation analyses carried out in educational psychology and general educational research have shown many of the same phenomena observed in other fields in the humanities and physical and social sciences documented in *Current Contents*[®] (CC[®])³ and other publications.⁴ Educational psychologists, for example, who publish more tend to be cited more often and win scientific awards and prizes.⁵

As in other fields, moreover, small numbers of researchers account for large percentages of all publications and citations. Typically, in a given year, the individual educational psychologist might produce one

publication and have his or her work cited once; a few researchers, however, accumulate vast numbers of both publications and citations.

For example, Sigmund Freud, Jean Piaget, and B.F. Skinner—all influential on midcentury educational psychology—each might equal several thousand lesser psychologists in citations. The resulting positive-skew distributions are known variously as J-curves in psychology, Zipf plots in linguistics, and Pareto distributions in economics. In contrast to "normal" bell-shaped curves, they describe many human and social phenomena such as wealth and income, human accomplishments, word frequencies, lengths of trips, and city sizes.⁶

Analysis of citations shows educational research journals to be a heterogeneous complex. Citations in 66 journals, for example, suggested divisions of the field into specialties varying from the more academic (emphasizing historical, psychological, and sociological perspectives) to professional and applied areas (including administration, evaluation, and teaching).⁷ Content analysis of eight core journals of research on higher education showed their distinctive emphases ranging across many categories from "analytical science" to "particular humanism."⁸

A factor analysis of 53,150 hand-counted citations in 40 leading educational research journals showed eight clusters. They included an educational research core; general, cognitive, and developmental psychology; methods of research; sociology; and reading and science.⁹ With three clusters, pure psychological specialties obviously dominate; they cite one another and are in turn cited by more applied or practitioner journals, but they tend less often to cite applied and practitioner journals. The subjects of study are hardly exhausted by reading and science. Had a larger number of journals been included—for example, those concentrating on mathematics, foreign languages, medicine, and other areas of education—other clusters of mutually citing papers might have been formed. Since education is a vast field, other clusters of specialty journals might also

emerge—for example, those concerning early childhood, the handicapped, and adult students.

Previous studies of hand-counted citations exhausted students and have been relatively limited in scope, method, and detailed numerical analysis. In working on this project, it was a pleasure to have access to the ISI® database and to computer analysis of its data that was performed at my request.

Core Journals

Table 1 lists the 16 “core” journals in educational psychology, selected mainly because they are frequently cited by each other

and related journals of educational psychology and closely allied fields.

The 16 core journals constitute 1.2 percent of the 1,391 *Social Sciences Citation Index*® (SSCI®) journals covered by ISI's *Journal Citation Reports*® for 1988—the most recent complete year chosen for the present analysis. During 1988 the 16 core journals published 627 articles (or other items), cited 16,291 articles, and were themselves cited 8,492 times. Twelve of the journals are published in the US, three are published in the UK, and one in The Netherlands.

For at least two reasons, three reading journals appear in the core. Psychologists

Table 1: Core educational psychology journals indexed in the 1988 SSCI®, with their editors, years of origin (in parentheses), 1988 impact factors (in brackets), and publishers.

American Educational Research Journal (1964) [1.28] V. Richardson-Koehler, ed. American Educational Research Association Washington, DC	Journal of Educational Psychology (1910) [1.39] J.T. Levin, ed. American Psychological Association Arlington, VA
British Journal of Educational Psychology (1931) [0.39] H. Francis, ed. British Psychological Society Scottish Academic Press Edinburgh, United Kingdom	Journal of Educational Research (1920) [0.39] H.E. Mitzel, W. Otto & J.D. Raths, eds. Helen Dwight Reid Educational Foundation Washington, DC
Contemporary Educational Psychology (1976) [0.48] A.J. Edwards, ed. Academic Press Duluth, MN	Journal of Reading Behavior (1969) [0.43] M.L. Kamil, ed. National Reading Conference Chicago, IL
Educational Psychologist (1963) [N/A] C.E. Weinstein, ed. Division of Educational Psychology American Psychological Association Lawrence Erlbaum Associates Hillsdale, NJ	Journal of Teacher Education (1950) [0.55] T.J. Lasley, ed. American Association of Colleges for Teacher Education Washington, DC
Educational Research (1958) [2.29] C. Burstall, S. Hegarty & D. Upton, eds. National Foundation for Educational Research Windsor, United Kingdom	Reading Research Quarterly (1965) [2.78] International Reading Association Newark, DE
Elementary School Journal (1900) [0.64] T. Good, ed. University of Chicago Press Chicago, IL	Reading Teacher (1947) [0.25] J.R. Binkley, ed. International Reading Association Newark, DE
Harvard Educational Review (1931) [2.60] Harvard University Graduate School of Education Cambridge, MA	Review of Educational Research (1931) [2.30] P.L. Peterson, ed. American Educational Research Association Washington, DC
Higher Education (1971) [0.52] A.M. Ross, ed. Kluwer Academic Publishers Dordrecht, The Netherlands	Teaching and Teacher Education (1985) [N/A] M.J. Dunkin, ed. Pergamon Press Oxford, United Kingdom

Table 2: The 50 journals most cited by the core educational psychology journals in the 1988 SSC/®. Asterisks (*) indicate core journals. A=citations from core journals. B=citations from all journals. C=self-citations. D=percent of total citations that are core-journal citations (A/B). E=percent of total citations that are self-citations (self-cited rate, C/B). F=percent of core-journal citations that are self-citations (C/A). G=1988 impact factor. H=1988 immediacy index. I=total 1988 source items.

	A	B	C	D	E	F	G	H	I
*J. Educ. Psychol.	716	2,314	217	30.9	9.4	30.3	1.39	0.09	76
*Read. Res. Quart.	278	712	75	39.0	10.5	27.0	2.78	0.26	23
*Rev. Educ. Res.	276	982	53	28.1	5.4	19.2	2.30	0.00	17
*Amer. Educ. Res. J.	214	661	22	32.4	3.3	10.3	1.28	0.27	15
Annu. Meet. Amer. Educ. Res.	212	603	---	35.2	---	---	N/A	N/A	N/A
*J. Teach. Educ.	186	310	112	60.0	36.1	60.2	0.55	0.12	58
*Elem. Sch. J.	173	427	57	40.5	13.4	33.0	0.64	0.48	40
Child Develop.	171	5,296	---	3.2	---	---	2.11	0.31	139
*Read. Teach.	144	272	73	52.9	26.8	50.7	0.25	0.07	139
*J. Educ. Res.	140	403	38	34.7	9.4	27.1	0.39	0.07	42
*Educ. Psychol.	126	346	24	36.4	6.9	19.1	1.97	0.57	23
J. Personal. Soc. Psychol.	116	8,994	---	1.29	---	---	2.26	0.34	193
*Harvard Educ. Rev.	104	578	27	18.0	4.7	26.0	2.60	0.10	20
J. Verb. Learn. Verb. Behav.	99	2,041	---	4.9	---	---	N/A	N/A	N/A
Educ. Leadership	97	443	---	21.9	---	---	0.46	0.16	128
Psychol. Bull.	95	6,337	---	1.5	---	---	4.55	0.51	67
*Educ. Res.	94	526	12	17.9	2.3	12.8	2.29	0.54	24
J. Exp. Child Psychol.	92	1,181	---	7.8	---	---	0.97	0.17	48
Psychol. Rev.	89	5,195	89	1.7	---	---	5.14	1.00	34
*Contemp. Educ. Psychol.	86	197	22	43.7	11.2	25.6	0.48	0.23	35
*Brit. J. Educ. Psychol.	79	356	46	22.2	12.9	58.2	0.39	0.12	33
Develop. Psychol.	79	2,683	---	2.9	---	---	1.34	0.19	97
*J. Read. Behav.	79	217	11	36.4	5.1	13.9	0.43	0.19	16
J. High. Educ.	77	272	---	28.3	---	---	1.44	0.04	27
J. Res. Sci. Teach.	77	563	---	13.7	---	---	1.00	0.00	50
Amer. Psychol.	76	4,691	---	1.6	---	---	2.84	0.57	122
Phi Delta Kappan	73	532	---	13.7	---	---	0.67	0.41	150
J. Learn. Disabil.	72	1,017	---	7.1	---	---	1.04	0.39	100
J. Read.	69	227	---	30.4	---	---	0.33	0.08	76
Mem. Cognition	69	1,593	---	4.3	---	---	1.54	0.25	63
Lang. Arts	65	183	---	35.5	---	---	N/A	N/A	N/A
Academe—Bull. AAUP	62	174	---	35.6	---	---	1.35	0.57	30
*Higher Educ.	57	142	51	40.1	35.9	89.5	0.52	0.00	39
Cognition Instruct.	53	158	---	33.5	---	---	N/A	N/A	N/A
Cog. Psychol.	51	1,712	---	3.0	---	---	3.38	0.28	18
Higher Educ. Rev.	49	56	---	87.5	---	---	N/A	N/A	N/A
Dissert. Abstr.	48	1,509	---	3.0	---	---	N/A	N/A	N/A
Sociol. Educ.	48	362	---	13.3	---	---	1.00	0.22	9
Except. Child.	42	991	---	4.2	---	---	2.62	0.63	54
Int. J. Inst. Manage. High. Educ.	41	43	---	95.4	---	---	N/A	N/A	N/A
J. Res. Math. Educ.	41	187	---	21.9	---	---	0.91	0.19	27
CRE Inform.	39	39	---	100.0	---	---	N/A	N/A	N/A
Hochschulwesen	39	42	---	92.9	---	---	N/A	N/A	N/A
Teach. Coll. Rec.	38	186	---	20.4	---	---	0.67	0.03	29
Res. High. Educ.	37	177	---	20.9	---	---	0.53	0.00	26
High. Educ. Europe	35	37	---	94.6	---	---	N/A	N/A	N/A
J. Exp. Educ.	35	170	---	20.6	---	---	0.25	0.07	31
Can. J. High. Educ.	34	50	---	68.0	---	---	N/A	N/A	N/A
Chron. High. Educ.	32	322	---	9.9	---	---	N/A	N/A	N/A
Psychol. Sch.	32	413	---	7.8	---	---	0.36	0.08	52

are still trying to solve age-old controversies such as relative effectiveness of the teaching of reading by phonics or "whole-word methods." Much of what is acquired in many subjects, moreover, including mathematics and science, is learned by reading and reflecting.

Journals Cited by the Core

Table 2 shows in order the 50 journals and other publications most often cited by educational psychology's core group (including themselves). Most are US-based journals, although there are also entries from the UK,

Canada, The Netherlands, the German Democratic Republic, and Romania.

The well-regarded *Journal of Educational Psychology*, with origins back to the turn of the century, was cited by the 16 core journals 716 times—2.6 times more than the next most frequently cited journal. Citation frequency rapidly drops to much lower rates, illustrating the ubiquitous Pareto-Zipf-J distribution.

One reason that the *Journal of Educational Psychology* gives and gets the most core citations is that it publishes numerous articles—76 in 1988, in contrast to 15 published by the *American Educational Research Journal*. (By way of comparison, the average number of source items per journal in the 1988 *SSCI* is 34.72; *Science* and *Nature*, on the other hand, each published in the neighborhood of 1,000 source items in 1988.)

While the disparity between the *Journal of Educational Psychology* and the *American Educational Research Journal* in terms of the number of published articles may seem striking, the impact factor given in column G corrects for this by dividing citations by the number of articles published. To obtain the 1988 impact factor in column G, the number of 1988 citations to each journal's 1986 and 1987 articles was divided by the total number of articles the journal published in those two years. It can be seen that the *Journal of Educational Psychology* and the *American Educational Research Journal* are roughly equal in impact. As in other fields, review and integrative journals tend to have the highest impact—notably, the *Harvard Educational Review*, the *Review of Educational Research*, *Educational Psychologist*, *Psychological Bulletin*, and *Psychological Review*.

Professional Journals

In accord with their purposes, the core educational psychology journals not only cite pure academic journals but also cite (to a lesser extent) professional and practitioner journals such as *Educational Leadership* and *Phi Delta Kappan* with readerships of more than 100,000, rivalling *Science*. The core

journals also cite the *Journal of Learning Disabilities* and other specialty journals investigating distinctive practical problems of handicapped and other special learners.

Fifth in citation rank are papers read at the annual meeting of the 15,000-member American Educational Research Association (AERA). Along with the Educational Psychology Division of the American Psychological Association, AERA is the primary outlet for convention papers. Researchers often cite such papers because of long time lags of published versions.

The prime research journal of AERA, the *American Educational Research Journal*, ranks fourth rather than higher probably because it publishes other than strictly psychological research. The same is true of the *Journal of Educational Research* and similar journals. Accordingly, anthropologists, sociologists, historians, and other educational researchers complain of the psychologist's dominance of these and other educational research journal outlets.

Higher Education Journals

Eight of the 50 journals in Table 2 concern university and other forms of postsecondary education. Their presence reflects psychologists' interest in college students' learning and the students' frequent participation as subjects in psychological experiments.

Cognitive Psychology

Three cognitive journals appear in Table 2. Their presence confirms the view that cognitive psychology is currently preeminent among psychology's ancient triumvirate of thinking, feeling, and behaving. The intellectual descendants of the Swiss child psychologist Piaget, who emphasized thinking, are more influential than those of Freud and Skinner, who respectively stressed emotions and behavior. Publications in these cognitive journals include computer simulations and detailed analyses of the ways in which children think and acquire knowledge.

Table 3: The 50 journals that most frequently cited the core educational psychology journals in the 1988 SSC[®].

Asterisks (*) indicate core journals. A=citations to core journals. B=citations to all journals. C=self-citations. D=percent of total citations that are core-journal citations (A/B). E=percent of total citations that are self-citations (self-cited rate, C/B). F=percent of core-journal citations that are self-citations (C/A). G=1988 impact factor. H=1988 immediacy index. I=total 1988 source items.

	A	B	C	D	E	F	G	H	I
*J. Educ. Psychol.	429	1,856	217	23.1	11.7	50.6	1.39	0.09	76
*Rev. Educ. Res.	288	1,862	53	15.5	2.8	18.4	2.30	N/A	17
*Elem. Sch. J.	257	1,349	57	19.1	4.2	22.2	0.64	0.48	40
*Read. Res. Quart.	230	1,023	75	22.5	7.3	32.6	2.78	0.26	23
Rem. Spec. Educ.	219	1,622	---	13.5	---	---	N/A	N/A	N/A
*J. Teach. Educ.	203	1,221	112	16.6	9.2	55.2	0.55	0.12	58
*J. Educ. Res.	201	954	28	21.1	2.9	13.9	0.39	0.07	42
*Educ. Psychol.	188	774	24	24.3	3.1	12.8	1.97	0.57	23
*Read. Teach.	180	1,262	73	14.3	5.8	40.6	0.25	0.07	139
*Contemp. Educ. Psychol.	155	751	22	20.6	2.9	14.2	0.48	0.23	35
J. Learn. Disabil.	145	2,890	---	5.0	---	---	1.04	0.39	100
*J. Read. Behav.	141	572	11	24.7	1.9	7.8	0.43	0.19	16
*Teach. Teach. Educ.	139	813	7	17.1	0.9	5.0	N/A	0.11	27
J. Read.	134	1,053	---	12.7	---	---	0.33	0.08	76
Educ. Leadership	130	1,060	---	12.3	---	---	0.46	0.16	128
*Brit. J. Educ. Psychol.	128	748	46	17.1	6.1	35.9	0.39	0.12	33
J. Exp. Educ.	107	589	---	18.2	---	---	0.25	0.07	31
School Psychol. Rev.	99	2,105	---	4.7	---	---	0.93	0.45	58
*Amer. Educ. Res. J.	96	532	22	18.0	4.1	22.9	1.28	0.27	15
Educ. Psychol. Meas.	94	1,493	---	6.3	---	---	0.29	0.06	124
Top. Lang. Disord.	88	938	---	9.4	---	---	0.27	0.05	20
Phi Delta Kappan	87	959	---	9.1	---	---	0.67	0.41	150
J. Res. Math. Educ.	80	1,022	---	7.8	---	---	0.91	0.19	27
Except. Child.	79	1,325	---	6.0	---	---	2.62	0.63	54
J. Educ. Comput. Res.	75	793	---	9.5	---	---	N/A	N/A	N/A
J. Res. Sci. Teach.	68	1,191	---	5.7	---	---	1.00	0.00	50
*Higher Educ.	68	1,328	51	5.1	3.8	75.0	0.52	0.00	39
Learn. Disability Quart.	64	534	---	12.0	---	---	1.52	0.11	19
Psychol. Rep.	63	4,816	---	1.3	---	---	0.22	0.24	38
Instr. Sci.	62	682	---	9.1	---	---	0.48	0.00	20
Appl. Cognitive Psychol.	61	595	---	10.3	---	---	0.23	0.00	20
TESOL Quart.	59	968	---	6.1	---	---	0.69	0.00	30
Psychol. Bull.	58	5,255	---	1.1	---	---	4.55	0.51	67
Education	56	759	---	7.4	---	---	N/A	N/A	N/A
J. Coll. Stud. Pers.	55	1,614	---	3.4	---	---	0.27	0.00	111
Teach. Coll. Rec.	54	748	---	7.2	---	---	0.67	0.03	29
Educ. Admin. Quart.	53	636	---	8.3	---	---	0.50	0.03	30
J. Spec. Educ.	53	752	---	7.0	---	---	0.48	0.04	26
Child Develop.	50	4,525	---	1.1	---	---	2.11	0.31	139
Res. Teach. Engl.	50	949	---	5.3	---	---	1.50	0.39	23
ECTJ—Educ. Commun. Technol. J.	48	460	---	10.4	---	---	0.24	0.07	15
Sci. Educ.	47	1,339	---	3.5	---	---	0.74	0.00	37
Young Child.	47	1,379	---	3.4	---	---	1.01	0.39	51
Percept. Mot. Skills	46	3,696	---	1.2	---	---	0.19	0.06	319
Educ. Rev.	44	828	---	5.3	---	---	0.18	0.00	25
Cognition Instruct.	43	220	---	19.5	---	---	N/A	N/A	N/A
J. Comput.-Base. Instr.	43	382	---	11.3	---	---	0.46	0.00	23
Res. High. Educ.	43	667	---	6.4	---	---	0.53	0.00	26
*Educ. Res.	42	368	12	11.4	3.3	28.6	2.29	0.54	24
J. Curriculum Stud.	42	1,145	---	3.7	---	---	0.58	0.08	38

Journals Citing the Core

As may be anticipated given educational psychology's mediating role, many journals citing the core, shown in Table 3, are more

applied than the core itself. We might expect to find similar phenomena in other professions such as engineering, medicine, and social work. Professions draw upon basic

research journals in synthesizing research and drawing practical implications.

Table 3 shows several groups of journals on similar topics. These topics include child psychology, computer-based learning, higher education, teacher education, reading, English-language acquisition, science education, and general curriculum. Table 3 also shows that the relative impacts of integrative and review journals are generally higher than other journals.

Research Fronts

To characterize areas of intense research activity, ISI data are employed in identifying research fronts. These fronts are formed when authors cite relevant papers in their fields. Papers that are frequently cited together, or co-cited, form the core of the front; papers associated in this way may share key theories, methods, or discussion. Fronts also consist of the "citing" papers—those papers in a given year that have cited the core articles. A large number of citing papers can be an indicator of interest or activity in a given specialty, although various other factors must be weighed (some fields, for example, are simply more crowded with authors and thus have larger "citing populations"). Table 4 shows eight 1988 research fronts that include at least 20 citing articles published in the educational psychology core journals.

Reading Comprehension

Research fronts #88-0080 and #88-1627 concern cognitive psychological research on reading comprehension. Psychologists working in this area have noted that children concentrate excessively on basic reading skills and on finding answers to questions raised by textbooks or teachers. Thus, there is little emphasis placed on learning to formulate questions or set goals for themselves. Encouraging children to set reading goals, monitor their own progress, and change their tactics when necessary enables them to achieve greater levels of comprehension and independence. Research front #88-3063 indicates similar work in the teaching of written composition.

Initiatives for Special Students

Research fronts #88-0914 and #88-1250 concern the "regular education initiative" and other strategies to bring mildly handicapped children with mental retardation, behavioral, emotional, or other learning disabilities into regular classrooms. Proposed by Madelaine Will, then US Assistant Secretary of Education for the Office of Special Education and Rehabilitative Services, the initiative remains controversial and thus generates many articles and citations. Proponents point to spurious and invidious classifications of children, the harms of segrega-

Table 4: The 1988 *SCI*[®]/*SSCI*[®] research fronts that include at least 20 citing documents published in the core educational psychology journals. A = number of articles from core educational psychology journals citing the core of each front. B = total number of citing documents. C = total number of core documents.

Number	Name	A	B	C
88-0080	Text recall, memory for story, knowledge in discourse comprehension, and summarization strategies	42	292	17
88-0136	Attributional style, depression coping questionnaire, family caregivers, and emotional response	22	875	54
88-0914	Active instruction for students, high-school science, classroom lessons, learning time, regular education initiative, and alternative perspectives	55	139	16
88-1080	Historical perspectives, changing appeal, mathematics education, organizational performance, and inexact sciences	59	303	38
88-1250	Regular education initiative, adaptive learning environments model, and group instruction	25	201	30
88-1627	Reading performance, comprehension instruction, poor readers, learning-disabled students, and metacognitive strategies	45	109	9
88-1882	Teacher expectations, ability groups, and pupils' performance	29	148	13
88-3063	Cognitive technologies for writing, young children's composing, and syntax of if-clauses	39	433	57

Table 5: The most-cited article from each core educational psychology journal according to the 1966-1988 SSCJ[®]. Because of its recent (1985) founding date, data are unavailable for *Teaching and Teacher Education*. A = 1966-1988 citations. An asterisk (*) indicates that the paper was the subject of a *Citation Classic*[®] commentary. The issue, year, and edition of *Current Contents*[®] in which the commentary appeared follow the bibliographic reference. The *SCJ*[®]/*SSCI* research-front numbers for 1988 also follow the reference.

A	Bibliographic Data
99	Bernstein B. Social structure, language and learning. <i>Educ. Res.</i> 3:163-76, 1961.
45	Biggs J. Individual differences in study processes and the quality of learning outcomes. <i>Higher Educ.</i> 8:381-94, 1979.
282	*Costin F, Greenough W T & Menges R J. Student ratings of college teaching: reliability, validity, and usefulness. <i>Rev. Educ. Res.</i> 41:511-35, 1971. (25/82/S&BS) 88-0119
180	Durkin D. What classroom observations reveal about reading comprehension instruction. <i>Read. Res. Quart.</i> 14:481-533, 1979.
149	Fennema E & Sherman J. Sex-related differences in mathematics achievement, spatial visualization and affective factors. <i>Amer. Educ. Res. J.</i> 14:51-71, 1977. 88-2261
60	Fredrick W C & Walberg H J. Learning as a function of time. <i>J. Educ. Res.</i> 73:183-94, 1980.
90	*Good T L. Teacher effectiveness in the elementary school. <i>J. Teach. Educ.</i> 30:52-64, 1979. (4/86/S&BS)
53	Guszk F J. Teacher questioning and reading. <i>Read. Teach.</i> 21:227-34, 1967.
1,013	*Jensen A R. How much can we boost IQ and scholastic achievement? <i>Harvard Educ. Rev.</i> 39:1-123, 1969. (41/78) 88-0914
102	Marton F & Säljö R. On qualitative differences in learning: 1. Outcome and process. <i>Brit. J. Educ. Psychol.</i> 46:4-11, 1976.
66	Paris S G, Lipson M Y & Wixson K K. Becoming a strategic reader. <i>Contemp. Educ. Psychol.</i> 8:293-316, 1983. 88-1627
82	Pearson P D, Hansen J & Gordon C. The effect of background knowledge on young children's comprehension of explicit and implicit information. <i>J. Read. Behav.</i> 11:201-9, 1979.
467	Weiner B. A theory of motivation for some classroom experiences. <i>J. Educ. Psychol.</i> 71:3-25, 1979. 88-0136
106	Wepman J M. Auditory discrimination, speech, and reading. <i>Elem. Sch. J.</i> 60:325-33, 1960.
86	Witrock M C. Learning as a generative process. <i>Educ. Psychol.</i> 11:87-95, 1974.

tion, and the inferiority of special instruction. Critics fear that federal funds will be withdrawn from special programs.

Other Research Fronts

Research front #88-0136 concerns emotions and the capacities of children to assume responsibility for learning rather than attributing results to talent or luck. Research front #88-1882 concerns how grouping students of like abilities and high expectations by teachers may affect learning. Finally, research front #88-1080 is a cluster of policy articles on the history of educational research, its inexactness, society's expectations for it, and how it may affect school performance.

Most-Cited Core Articles

Table 5 shows the most-cited articles from each core journal for 1966-1988 in alphabetic order by first author. Four concern various social inequalities: an article on how nonstandard language limits British students'

educational progress, by Basil Bernstein, University College, London; a paper examining how differences in students' study strategies affect their learning, by John Biggs, Faculty of Education, University of Newcastle, New South Wales, Australia; and an article on girls' visualization and emotional problems in mathematics by Elizabeth Fennema, Department of Curriculum and Instruction, University of Wisconsin, Madison, and Julia Sherman, Women's Research Institute of Wisconsin, Inc., Madison. A paper by Arthur R. Jensen, Department of Education, University of California, Berkeley, concerns the limitations of educational efforts to boost poor children's ability and achievement; this controversial article dwarfs the others in citations. The citation impact of Jensen's work was analyzed in a 1978 CC essay.¹⁰ Another of the most-cited articles, by Wayne C. Fredrick, Board of Education, Chicago Public Schools, and Walberg, shows that achievement is a partial function of time invested in learning.

Table 6: Articles published in noncore journals cited at least seven times by core educational psychology journals in the 1988 SSCJ®. A = 1988 citations from core journals. B = total 1966-1988 SSCJ citations. An asterisk (*) indicates that the paper was the subject of a Citation Classic® commentary. The issue, year, and edition of Current Contents® in which the commentary appeared follow the bibliographic reference. The SSCJ®/SSCJ research-front numbers for 1988 also follow the reference.

A	B	Bibliographic Data
7	471	Bandura A. Self-efficacy mechanism in human agency. <i>Amer. Psychol.</i> 37:122-47, 1982. 88-1737
8	1,502	* Bandura A. Self-efficacy: toward a unifying theory of behavioral change. <i>Psychol. Rev.</i> 84:191-215, 1977. (20/89/S&BS) 88-1737
8	358	Bransford J D & Johnson M K. Contextual prerequisites for understanding: some investigations of comprehension and recall. <i>J. Verb. Learn. Verb. Behav.</i> 11:717-26, 1972.
7	75	Brown A L. Knowing when, where, and how to remember: a problem of metacognition. <i>Advan. Instr. Psychol.</i> 1:77-165, 1978.
7	1,655	* Craik F I M & Lockhart R S. Levels of processing: a framework for memory research. <i>J. Verb. Learn. Verb. Behav.</i> 11:671-84, 1972. (50/79/S&BS) 88-4366
7	194	Diener C I & Dweck C S. An analysis of learned helplessness: continuous changes in performance, strategy, and achievement cognitions following failure. <i>J. Personal. Soc. Psychol.</i> 36:451-62, 1978.
7	36	Doyle W & Ponder G A. The practicality ethic in teacher decision-making. <i>Interchange</i> 8:1-12, 1977. 88-1080
8	391	Dweck C S. The role of expectations and attributions in the alleviation of learned helplessness. <i>J. Personal. Soc. Psychol.</i> 31:674-85, 1975. 88-4971
7	568	Kintsch W & van Dijk T A. Toward a model of text comprehension and production. <i>Psychol. Rev.</i> 85:363-94, 1978. 88-0080
8	557	LaBerge D & Samuels S J. Toward a theory of automatic information processing in reading. <i>Cog. Psychol.</i> 6:293-323, 1974.
19	123	Palincsar A S & Brown A L. Reciprocal teaching of comprehension-fostering and comprehension-monitoring activities. <i>Cognition Instruct.</i> 1:117-75, 1984. 88-1627
8	91	Weiner B. An attributional theory of achievement motivation and emotion. <i>Psychol. Rev.</i> 92:548-73, 1985. 88-0136

Three articles concern reading comprehension, especially from a cognitive point of view—by Dolores Durkin, University of Illinois, Urbana; Scott G. Paris, School of Education, University of Michigan, Ann Arbor, and colleagues; and P. David Pearson, University of Illinois, and colleagues. M.C. Wittrock, Department of Education, University of California, Los Angeles, treats the more general process of how learners construct their own learning rather than having it imposed on them.

Frank Costin and colleagues, Department of Psychology, University of Illinois, examine the validity and usefulness of student ratings of college teachers. Similarly, Thomas L. Good, Center for Research in Social Behavior, University of Missouri, Columbia, and Frank J. Guszak, University of Texas, Austin, deal with issues in teacher effectiveness. Other articles include a discussion of theories on how motivation affects learning by Bernard Weiner, Department of Psychology, University of California, Los Angeles; an examination of how

qualitative differences among learners affect outcomes by F. Marton and R. Säljö, Institute of Education, University of Göteborg, Sweden; and a paper by Joseph M. Wepman, University of Chicago, Illinois, on how listening, speech, and reading skills are related.

Most-Cited Noncore Articles

Table 6 shows the most widely cited articles published in each of the 12 noncore journals cited at least seven times by core journals in 1988. With the exceptions of *Interchange* and *Cognition and Instruction*, these noncore journals concern pure psychology. Three authors contributed two papers each to this list of most-cited articles—again illustrating the Pareto-Zipf-J phenomenon. These authors are Carol S. Dweck, Department of Psychology, University of Illinois; Ann L. Brown, Center for the Study of Reading, University of Illinois; and Albert Bandura, Department of Psychology, Stanford University, California, who is one of the most-cited living psychologists.

Five articles examine how learners acquire beliefs and how it affects their learning and coping. Two of these papers are by Bandura, while another is by Carol I. Diener, University of Illinois, and Dweck. Dweck as sole author accounts for another of these papers, as does Weiner, who is the only psychologist with top-cited articles appearing in both the core and noncore sets.

Another group of articles concern reading comprehension and information processing. Two of these were written by Brown (one as sole author, one with colleague and first author Annemarie Sullivan Palincsar). Others of these papers are by Fergus I.M. Craik and Robert S. Lockhart, University of Toronto, Ontario, Canada; Walter Kintsch, Department of Psychology, University of Colorado, Boulder, and Teun A. van Dijk, University of Amsterdam, The Netherlands; and David LaBerge and S. Jay Samuels, Department of Psychology, University of Minnesota, Minneapolis. It is striking that these articles are largely theoretically integrative. The remaining article, by Walter Doyle and Gerald A. Ponder, North Texas State University, Denton, may add balance to the list in its concern for practicality in teacher decision-making—a balance perhaps required by educational psychology.

Conclusions

The research literature in educational psychology shares several statistical characteristics of other scientific fields, particularly the comparative rarity of very highly cited scientists, articles, and journals. Its most-cited articles, moreover, tend to review and theoretically integrate the empirical work of the field.

Unlike many scientific fields, however, educational psychology straddles the two disciplines implied in its name. Accordingly, its journals cite relatively "pure" research in psychological journals as well as applied problems in educational journals. Its current research fronts, moreover, reflect issues in both fields—for example, mental processing of textual information in psychology and the integration of handicapped learners into regular classrooms in education.

In a subsequent article, I will analyze the special characteristics of the literature on education in mathematics and science. For suggestions on an earlier version of the present article, I thank Joel T. Levin, Elizabeth Fuseler-McDowell, John C. Smart, and Eugene Garfield.

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