Educational Research and Policy Making

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Educational Research, History of

Educational research as disciplined inquiry with an empirical basis was first known as “experimental pedagogy”. This term was analogous to that of “experimental psychology”, an expression coined by Wundt in Leipzig around 1880. Experimental pedagogy was founded around 1900 by Lay and Meumann in Germany; Binet and Simon in France; Rice, Thorndike, and Judd in the United States; Claradé in Switzerland; Mercante in Argentina; Schuytten in Belgium; Winch in England; and Sikorskaja and Netchajaev in Russia. Some years earlier, three publications—The Mind of the Child by Preyer, a German psychologist, in 1882; The Study of Children by Stanley Hall from America in 1883; and articles by an English psychologist, Sully, in 1884 concerned with children’s language and imagination—marked the beginning of the child study movement. Although progress was slow during the 1880s the foundations were laid through this movement for research into related educational problems. From 1900 onwards, the study of educational questions developed rapidly and three movements can be identified: (a) the child study movement, where educational research was associated with applied child psychology; (b) the New Education or progressive movement where philosophy took precedence over science, and life experience over experimentation; and (c) the scientific research movement with a positivist approach. This article is primarily concerned with the third movement which involves empirical research.

In the first major identifiable period (1900–1930), Cronbach and Suppes (1966) speak of a “heyday of empiricism”, empirical educational research focused on rational management of instruction, challenging the concept of transfer of training, psychology of school subjects, development of new curricula, psychological testing, administrative surveys (school attendance, failure rates, etc.), and norm-referenced achievement surveys. Descriptive statistics were already well-established and in the 1920s and 1930s, inferential statistics and multivariate data analysis developed rapidly (see Statistical Analysis in Educational Research).

In the second period (1930 to the late 1950s), however, the strict scientific approach to education lost impetus to make room, practically all over the developed world, for the more philosophically oriented and innovative progressivism. Behind this shift were three factors: (a) the atomistic character of most educational research; (b) a questioning of the scientific approach to the management of education at a time when there was an economic crisis soon to be followed by war; and (c) the changes in the progressive movement with its combination of empirical research and a social and political philosophy merging the free enterprise, liberal spirit with humanistic socialism.

Nevertheless, during this period interest in cognitive development and language studies continued with the work of Piaget in Switzerland, and Vygotsky, who died in 1934, and his associates Luria and Leontief in the Soviet Union. In addition, a new strand of enquiry was opened up in the field of the sociology of education with the publication in 1944 of Who Shall Be Educated by Warner, Havigurst, and Loeb in the United States. These authors brought together a substantial body of research to establish that schooling in the United States favoured white children from an urban middle-class background. Other studies into adolescence and adolescent development soon followed.

In the third period (1960s and 1970s) the knowledge "explosion" took place and its applications to technology really began (see Knowledge Explosion). Educational research was soon influenced by this dynamic development. Challenged by the sociotechnical advance (e.g., Sputnik) and being economically affluent, United States governments and private agencies supported educational research to an unprecedented extent and so the paradigm of educational research took on a whole new shape.

However, the educational problem remained the same throughout this period, the relative success of the West European countries was achieved by political factors and not through educational research. The problem of educational research as a tool of policy decision making still remains.

1. Pre-1990

It is certainly not true that the educational policy maker is a student of educational science educated for a period of about 25 years (to 1990), and after this period he has to deal with a new educational problem that is not defined in his educational research. In this sudden rise

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A developed rapidly. It was based on three fundamental ideas: (a) the nature of research was not just scientific but also philosophical; (b) the research was conducted in a way that was as objective and uncontaminated as possible; and (c) the research was focused on understanding and explaining the behavior of scientific subjects.

The period of educational research was characterized by a new emphasis on the importance of data collection and analysis. The introduction of new techniques, such as the use of statistical methods, allowed researchers to draw more accurate conclusions about the nature of learning and teaching.

The research in educational psychology was influenced by the work of such figures as Piaget, Vygotsky, and Leont'ev. Their ideas about the nature of development and learning were reflected in the research conducted at the time.

The research in the 1960s was marked by a greater emphasis on the role of the environment in shaping behavior. This was reflected in the research conducted by researchers such as Skinner, Bandura, and others.

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At that time, many students, particularly from the United States, completed their advanced education at the universities of Berlin, Leipzig, Heidelberg, or Jena. This explains the extraordinary rapid dissemination of Wundt’s ideas: Cattell, Hall, Judd, Rice, and Valentine were among his students. His work was immediately known in France by Ribot and Binet, in Russia by Netchajev, in Japan by Matsumoto, in Santiago, Chile by Mann, and in Argentina by Mercante. Psychological laboratories were soon opened on both sides of the Atlantic.

In the meantime, certain key events were associated with the birth of modern educational research:

1885 Ebbinghaus’s study on memory drew the attention of the education world to the importance of associations in the learning process.

1888 Binet published his Études de Psychologie Experimenterale; at that time he was already working in schools.

1890 The term mental test was coined by Cattell.

1891 Stanley Hall launched the review Pedagogical Seminary.

1894 Rice developed a spelling test to be administered to 16,000 pupils. He published the results of his testing in his Scientific Management of Education in 1913.

1895 In the United States, the National Society for the Scientific Study of Education was founded (initially called the National Herbart Society for the Scientific Study of Teaching).

1896 In Belgium, Schuyten published a report of his first educational research study on the influence of temperature on school children’s attention. Dewey, a student of Stanley Hall, opened a laboratory school at the University of Chicago.

1897 Thorndike studied under James at Harvard and there discovered the works of Galton and Binet. Ebbinghaus published his so-called completion test to measure the effect of fatigue on school performance. This can be considered to be the first operational group test. In the same year Binet began to work on his intelligence scale.

1898 Lay suggested distinguishing experimental education from experimental psychology. Binet and Henri condemned traditional education in their book La Fatigue Intellectuelle and indicated the need for experimental education.

1899 Schuyten opened a pedological laboratory in Antwerp (Belgium) to study experimentally, among other things, group teaching methods.

Who is the father of “experimental pedagogy”? The answer to this question differs whether the activity covered by the term or the term itself is considered. Empirical research in education definitely existed before 1900. Many American authors, such as Binet, Lay, Mercante, or Schuyten, could also qualify. As for the term itself, it was coined by Meumann (Wundt’s former student) in 1900, in the German Zeitschrift für Pädagogik where he dealt with the scientific study of schooling. In 1903, Lay published his Experimentelle Didaktik where he made his famous statement about “... experimental education will become all education”. In 1905, Lay and Meumann together published the review Die Experimentelle Pädagogik. Subsequently, Meumann’s three-volume work Einführung in die Experimentelle Pädagogik (1910, 1913, 1914) emphasized both the strict scientific and quantitative side of the laboratory, while Lay continued to emphasize both qualitative and qualitative approaches (empathy, intention) in classroom research.

When did modern educational research appear in France? There is no doubt that Binet inspired it. In his introduction to his book La Fatigue Intellectuelle (1898), he wrote:

> Education must rely on observation and experimentation. By experience, we do not mean vague impressions collected by persons who have seen many things. An experimental study includes all methodically collected documents with enough detail and precise information to enable the reader to replicate the study, to verify it and to draw conclusions that the first author had not identified. (Simon 1924 p. 5)

It is obvious throughout the whole psychological work of Binet that he had a strong interest in education. In 1905, he founded the School Laboratory in rue Grande-aux-Bettes in Paris. With him were Vaney, who in 1907 published the first French reading scale and Simon, the coauthor of the Intelligence Scale (1905) and later author of the Pédagogie Experimentale. Binet and Simon’s Intelligence Scale presented in Rome at the 1905 International Conference of Psychology was the first truly operational mental test covering higher cognitive processes. Like Wundt’s ideas, Binet’s test became known throughout the world within a very few years. But beyond its intrinsic value, this test had a far greater historical significance. It was now acknowledged that a test could be a valid measurement instrument both in psychology and education.

In 1904, Claparède, a medical doctor, founded the Laboratory for Experimental Psychology at the University of Geneva with his uncle Flournoy. In 1892, Claparède had visited Binet in Paris and in the following year was, for a short time, Wundt’s student in Leipzig. In 1905, he published the first version of his Psychologie de l’Enfant... that was the only methods handbook on Experimental psychology in Geneva which over time contributed to the work of Dewey. Together with other leaders of progress, Dewey did not only change the understanding of scientific modern educational research advanced in the United States, but also the understanding of educational research in France and the United States.

2. The Flourishing of Educational Research: 1900 to 1930

In the early 20th century, education was no longer the province of those who could afford it but a public good, a public service. For the first time in history, education could be provided to all, at least in theory. The idea of equality of educational opportunity was gaining ground in the minds of people. The influence of Wundt’s ideas on the work of Binet and Claparède was evident. The work of the two men was characterized by a strong empirical and scientific approach to the study of education. They were both interested in the relationship between education and societal progress. Their work laid the foundation for the development of educational psychology as a science. Their ideas were widely influential in the field of education and continue to be studied and debated to this day.
this Psychologie de l’enfant et pédagogie expérimentale that was the only French educational research methods handbook until 1935 when Buyse published his Experimenterie in Pédagogie. In 1912, Claparédé established the J. J. Rousseau Institute in Geneva which over the next 50 years was to make a marked contribution to child study and education through the work of Jean Piaget. However, Claparédé remained mostly psychologically and philosophically oriented. With his theory of functional education, he was the European counterpart of John Dewey. Together they were seen as the two main leaders of progressive education.

Among many interesting features in the work of Claparédé following Dillthey’s work in 1892 on Verstehen vs. Erklären is his analysis, in 1903, of the explaining (positivist, nomothetic approach) versus the understanding (hermeneutic) approach. This elicited a debate which still lasts today.

At the end of Les Idées modernes sur les enfants, Binet (1924 p. 300) mentioned that “it is specially in the United States that the remodelling of education has been undertaken on a new, scientific basis”. In fact, at the beginning of the century, educational research advanced at an extraordinarily quick pace in the United States.

At Columbia University, Cattell, who had obtained his Ph.D. under Wundt and had known Galton in Cambridge, had, in 1890, as mentioned above, coined the term mental test in the philosophical journal Mind. In 1891, he established his psychological laboratory just above the laboratory for electricity. Under his supervision Thorndike completed his Ph.D. in 1898 on animal intelligence. Like many psychologists of the time he soon developed a keen interest in education. In this period, much attention was focused on objective measurement that the experimental educational movement was sometimes called “the measurement movement” (Jonich 1962).

Thorndike can be considered as the most characteristic representative of the scientific orientation in education. During the following decades, he dealt with all aspects of educational research. He was the first person to conceive of teaching methods in terms of an explicitly formulated and experimentally tested learning theory. In so doing, he opened a new teaching era. The influence of Thorndike in the field of educational research can probably be compared with the influence of Wundt in experimental psychology.

2. The Flourishing of Quantitative Research, from 1900 to 1930

During this period, most educational research was quantitatively oriented and geared to the study of effectiveness. For a while, Taylorism and the study of efficiency, became a component of educational thinking. The behavioural and antimentalist study of human behaviour was regarded as the best weapon against the formalism of the past.

The following aspects of research activities, although not comprehensive, are representative illustrations of the era.

2.1 Statistical Theory

It has sometimes been suggested that there is an inconsistency between the limitations of measurement in the social sciences and the rapidly increasing sophistication of the statistical techniques resorted to. However, it can be argued that many statistical advances were achieved by researchers in education precisely because they were aware of the complexity and the instability of most phenomena they had under study and had to look for increasingly sophisticated methods to obtain sufficient validity of measurement or else indicate the limitations of their conclusions.

The applicability of the Gaussian probability curve to biological and social phenomena was suggested at the beginning of the 1800s by Quetelet, who coined the term statistics. Galton was the first to make extensive use of the normal curve to study psychological problems. He sometimes preferred to express the same distributions with his ogive because this representation gave a better picture of the hierarchy of characteristics. Galton also suggested percentile norms. In 1875, he drew the first regression line, and developed the concept of correlation in 1877. In 1896, Pearson, who worked under Galton, published the formula for the product–moment correlation coefficient. In the first decade of the 1900s, the essentials of the correlational method, including the theory of regression, were well-developed, especially by British statisticians. Pearson and Yule. In the same period, Pearson developed the chi-square technique and the multiple correlation coefficient. Reliability was measured with the Spearman–Brown Formula. In 1904, Spearman published his analysis of a correlation matrix to sustain his two-factor theory and factor analysis began to emerge.

Researchers were also aware of the statistical significance of differences. They used rather crude methods indeed, but did not take many chances. Carroll has written:

Fortunately, American psychologists in the early days, tended to employ such a conservative standard in testing statistical differences (a “critical ratio” of four times the probable error, corresponding to $p < .007$) that at least it can be said that they only infrequently made “Type 1 errors.” (Carroll 1978 p. 20)

In 1908, under the name of Student, Gosset showed how to measure the standard error of the mean and the principle of the t-test was formulated. Experimental design was also used. In 1903, Schuyten used experimental and control groups. In 1910, McCull, a student of Thorndike and probably the first comprehensive the first version of an experimental
Mental tests were soon used in all industrialized countries. In particular, Binet’s scale was used in Europe, North and South America, and Australia, and was tried out in some African countries. This was far from being the case with achievement tests. Some fairly crude tests were used as research instruments but frequently remained unknown to the classroom teacher. It is, for instance, surprising to observe the lack of sophistication of the achievement tests developed in France after Binet and Simon. This continued until the 1940s, and the situation is particularly well-illustrated in the book by Ferré, Les Tests a l’école, a fifth edition of which appeared in 1961. It is all the more surprising since in the 1930s traditional examinations (essay and oral tests) were sharply criticized in England and in France where Piron coined the French word didactique, meaning “science of examinations”. Lack of validity, of reliability, and sociocultural bias were denounced with documented evidence. In Continental Europe, standardized achievement tests were not extensively used in schools.

2.3 Administrative and Normative Surveys
Among educational research endeavours, surveys are the oldest. In 1837, Marc Antoine Julien de Paris became the founder of comparative education by designing a 34-page national and international questionnaire covering all aspects of national systems of education. The questions were posed, but unfortunately not answered, at that time.

The modern questionnaire technique was developed by Stanley Hall at the end of the 1800s to show, among other things, that what is obvious for an adult is not necessarily so for a child. This observation has, of course, direct educational implications.

In 1892, Rice visited 36 towns in the United States and interviewed some 1,200 teachers about curriculum content and teaching methods. Subsequently he carried out a spelling survey (1895–1897) on 16,000 pupils and found a low correlation between achievement and time invested in drill. This survey was repeated in 1908 and in 1911 (Rice 1913). Thordike’s 1907 survey of dropouts was followed by a series of other surveys of school characteristics: differences in curricula, failure rate, teaching staff qualifications, school equipment and the like. The most comprehensive survey of the period was the Cleveland Schools Survey undertaken in 1915–16 by L. P. Ayres and a large team of assistants. The study was reported in 25 volumes each dealing with different aspects of urban life and education.

In Germany, France, Switzerland, and Belgium, similar but smaller surveys were carried out by “pedo-technical” offices such as that opened in 1906 in the Decroly School in Brussels.

Several large-scale psychological surveys were undertaken: the Berkeley Growth Study (1928), the Fell’s Study of Human Development (1929), and the Fourth Harvard Study (1930).
in all industrialized countries, a scale was used in America, Australia, and African countries. This was achievement testing, based as research instruments on tests of the classical observational methods of course of studies observed by teachers or seen in the classroom. The achievement tests were refined by René and Simon. In France, a similar project was proposed by Pierre Féré, Le test, which appeared in 1931 and was followed by a test in 1933. In the United States, the situation is much more complex, with the development of various tests by several authors, including U.S. and French authorities. The tests were not extensively used in French schools, although they were developed in the United States.

### 4.2 Curricular Development and Evaluation

Curriculum was one focus of attention of empirical educational research from its very beginning. The article, in 1900, in which Meumann used the term "principles pédagogiques" for the first time dealt with the scientific study of school subjects. Shortly afterwards, Thorndike introduced a new disease in curriculum development by conceptualizing teaching methods in terms of a "psychology of school branches", and demonstrating through his work the transfer of learning from one subject to another. This psychological approach was perfectly compatible with the new pragmatic philosophy and the attempts to rationalize work and work. Some years later, Dewey and Faris hoped to "tailor instruction to the needs of the pupil". The psychology of school subjects was also one of the most influential in the development of educational psychology in France. The Plan Langue-Vallée, for instance, highlights the importance of comprehensiveness in second language instruction in France.

### 3. From the 1930s to the late 1950s

The economic crisis of the 1930s made research funds scarce. The need for a new social order was interpreted differently: fascism in some countries (Germany, Italy, Japan); socialism in others (the Soviet Union and China). Progressivism, advocated by the New Education movement outside the United States, seemed to be an obvious educational solution in most democratic countries and a guarantee for the future of democracy.

The Second World War and the years immediately following froze most educational research activities in European countries. Freedom of research was not acceptable to dictators. In the Soviet Union, the utilization of tests (as incompatible with political decisions) and even generally the "pedagogical movement" were officially banned in 1936 by a resolution of the Communist Party, and the situation lasted until Stalin's death. However, other forms of research continued, arising from the publication in 1936 of "Thought and Language" by L.S. Vygotsky four years after his death in 1934, and the subsequent work of his associates such as Luria and Leontiev in the development of Pavlov's ideas. In occupied countries, school reorganization was planned by underground movements which tried to draw conclusions from previous experiments and to design educational systems for peace and democracy. The Plan Langue-Vallée-Wallon, for the introduction of comprehensive secondary education in France is an example.

Conditions were different in the United States, Australia, and in Sweden. Even if no spectacular advances occurred in educational research in those countries, the maturation of ideas went on and prepared the way for the postwar developments. War...
fare had again raised problems of recruitment and placement and the role of military psychology and the development of selection tests is exemplified by the work of Guilford in the United States and Husén and Boalt (1968) in Sweden.

The strong field of interest in the 1940s and 1950s was without doubt in sociological studies. The seminal investigations were those concerned with social status and its impact on educational opportunity. A series of studies in the United States showed the pervasive existence of the school's role in maintaining social distinctions and discriminatory practices. From this research it was argued that schools and teachers were the purveyors of middle-class attitudes and habits. These effects of schooling were particularly evident at the high-school stage, and this trend of research became closely linked to the study of adolescent development. This work spread to England in the mid-1950s and subsequently to other parts of the world and led to challenging the maintenance of selective schools and to establishing comprehensive high schools. This research emphasis on issues associated with educational disadvantage has continued subsequently, with concern for disparities in the educational opportunities provided for different racial and ethnic groups, for inner urban and rural groups and, in particular, for girls.

4. The 1960s and 1970s

During the first part of the 1960s in affluent countries educational research enjoyed for the first time in its history the massive support necessary for it to have a significant impact. This development was particularly marked in the United States. At that time money for research and curriculum development, particularly in mathematics and science, was readily available in the United States. In 1954, federal funds were first devoted through the Cooperative Research Act to a programme of research and development in education (Holtzman 1978). The big, private foundations also began to sponsor educational research on a large scale. The civil rights movement, Kennedy's New Frontier, and Johnson's Great Society continued the trend.

In 1965, the Elementary and Secondary Education Act was passed which authorized funding over a five-year period for constructing and equipping regional research and development (R & D) centres and laboratories. President Johnson implemented developments that had been planned under Kennedy and in 1968, federal support for educational research reached its peak: 21 R & D centres, 20 regional laboratories, 100 graduate training programmes in educational research, and thousands of demonstration projects, represented a total federal investment of close to 200 million dollars per year.

On a much smaller scale, a similar development took place in England. Wall (1968 p. 16) wrote:

In 1958, it was possible to demonstrate that expenditure of all kinds on research relating to education represented no more than 0.1 per cent of all expenditure on education: in 1967 the proportion may well be thirty times as much and will probably grow over the next decade.

A similar expansion took place in the Soviet Union. Between 1960 and 1970 the professional staff engaged in educational research increased considerably. In 1966, the Soviet Academy of Pedagogical Sciences took on its present status. Initially under the name of the Academy of the Russian Republic it was founded in 1943. In 1967, the Institut Pédagogique Nationale of France, for the first time, received significant funding for educational research. Girod de l'Ain (1967) considered 1967 as the Year 1 of educational research in France.

By the late 1960s, all highly industrialized countries were in the midst of a cultural crisis which had a deep impact on scientific epistemology and thus affected the research world. There was also talk about a "world crisis" (Coombs 1968) in education which applied in the first place to the imbalance between demand and supply of education, particularly in Third World countries. Deeply disappointed in their hope for general peace, wealth, and happiness, people realized that neither science and technology nor traditional—mostly middle-class—values had solved their problems. An anti-intellectualist counterculture developed, emphasizing freedom in all respects, rejecting strict rationality, glorifying community life. The value of "traditional" education was questioned. "Deschooling," nondoctrine, group experience, and participation seemed to many the alpha and omega of all pedagogy. This trend did not leave socialist countries unaffected. In May 1976, a group of researchers in the Soviet Union regretted a too rationalistic approach in educational research (Novikov 1977).

At the same time, scholars also began to question science, some with great caution and strong argumentation, others superficially in the line of the Zeitgeist. Kerlinger (1977) condemned the latter with ferocity: "mostly bizarre nonsense, bandwagon climbing, and guriasm, little related to what research is and should be".

This was not the case in the crucial epistemological debate inspired by scholars like Polanyi, Popper, Kuhn, and Piaget. Fundamentally, the world of learning acknowledged both the contemporary "explosion" of knowledge and the still, very superficial, comprehension of natural, human phenomena.

While Piaget (1972) showed in his Epistémologie des sciences de l'homme, that nomothetic and historical (anthropological) approaches are not mutually exclusive but complementary, in 1974, two of the best-known American educational researchers Cronbach (1974) and Campbell (1974), without previous mutual consultation, chose the annual meeting of the American Psychological Association as the occasion to call for a major reexamination of traditional methods and of alternative methods. Since the 1960s, the daily companion of the history of the explosion of calculational complexity is already existing statistical analysis, regression analysis, analysis of variance, the computer for desk calculus and statistical analysis. Large-scale, feasible simultaneous techniques were developed in Educational Research.

Huge surveys, such as those of the International Association for the Evaluation of Educational Achievement (IEA) and the National Center for Education Statistics, have been undertaken without the scientific experimental and quasi-experimental research can no longer be maintained.

Many scientific communication can be mentioned such as "The blackboard" communication on educational objectives, the Nagoya Test (the most important in the world), "explosion" of knowledge, and Summative Evaluation, the most influential of which is the International Test Commission (the most influential of which is the International Test Commission).

5. Developments in the 1970s

With the advent of the 1970s, the scientific community has been challenged to better define the boundaries of its discipline, to assess its impact, and to consider the implications of its findings for society. The need for a more coherent and comprehensive understanding of educational research has become increasingly apparent. The pivotal role of research in educational decision-making has been recognized, and there is a growing awareness of the importance of integrating research findings into educational practice.

Educational research has made significant contributions to the understanding of educational processes and outcomes. The development of new methodologies and the application of existing methods to new contexts have expanded the scope of inquiry. The integration of qualitative and quantitative approaches has led to more robust and nuanced research designs. The focus on equity and social justice has become a central concern, as researchers strive to address the complex interplay of individual and institutional factors in educational contexts.

The 1970s saw the emergence of a new generation of educational researchers, many of whom were trained during this period. This generation has contributed to the diversification of educational research, embracing a wide range of topics and methodologies. The dialogue between theory and practice has become more dynamic, with researchers seeking to bridge the gap between research findings and educational policy and practice.

Despite these developments, challenges remain. The complexity of educational systems and the diversity of contexts continue to present significant obstacles to research. Funding for educational research remains limited, and there is a need for sustained investment in this area. The integration of educational research into policy and practice remains a critical challenge, requiring collaboration across disciplines and sectors.

In conclusion, the 1970s saw significant advancements in educational research, marked by the expansion of research agendas, the adoption of innovative methodologies, and a greater focus on equity and social justice. As we move into the 21st century, the promise of educational research lies in its potential to drive innovation, inform policy, and ultimately enhance the well-being and opportunities of all learners.
of the American Psychological Association to react
against the traditional positivist emphasis on quan-
titative methods and stressed the critical importance
of alternative methods of inquiry.

Since the 1960s, the computer has become the
daily companion of the researcher. For the first time
in the history of humankind, the amount and com-
plexity of calculation are no longer a problem.
Already existing statistical techniques, like multiple
regression analysis, factor analysis, multivariate
analysis of variance, that previously were too onerous
for desk calculation suddenly became accessible in a
few moments. Large-scale research projects became
feasible. Simultaneously, new statistical methods
and techniques were developed (see Statistical
Analysis in Educational Research).

Huge surveys, such as Project Talent in the United
States and the mathematics and six subject surveys
of the International Association for the Evaluation
of Educational Achievement (IEA) would have been
unthinkable without powerful data-processing units.
Campbell and Stanley’s (1963) presentation of
experimental and quasiexperimental design for edu-
cational research can be considered to be a landmark.
Scientific developments in the field of educational
research were not only stimulated by access to funds
and to powerful technology, but also by the
“explosion” of knowledge in the physical and social
sciences, especially in psychology, linguistics, eco-
nomics, and sociology (see Instructional Psychology;
Economics of Education; Sociology of Education).

Many scientific achievements in the field of edu-
cational research can be mentioned for the 1960s: the new ideas
on educational objectives (see Objectives, Educa-
tional, Taxonomies of), the new concepts of
criterion-referenced testing (see Criterion-referenced
Tests) (the most important advance in test theory
since Galton’s invention of normative testing),
formative and summative evaluation (see Formative
and Summative Evaluation), teacher–pupil inter-
action analysis, research on teacher effectiveness,
compensatory education for socioculturally handi-
capped children (see Compensatory Education),
the study of cognitive and affective handicaps, research
into the importance and methods of early education,
social aspects of learning aptitudes, deschooling
experiments, adult education (see Adult Education:
An Overview), the development of new curricula and
of an empirical methodology of curriculum develop-
ment and evaluation, and developments in re-
search methodology.

5. Developments in the 1980s

With the advent of the last quarter of the twentieth
century, the scientific status of educational research
has attained a level of quality comparable to that of
other disciplines. The epistemological debate of the
previous decade clarified considerably the respective
strengths and weaknesses of the qualitative and the
quantitative approaches. It is now widely acknowl-
edged that no one research paradigm can answer all
the questions which arise in educational research.

A clear impact of this scientific maturity can also
be spotted in educational practice. Both the scientific
quest for the most efficient standard teaching method
and the positivist improvisation (for a while
replaced by nondirectivity) have been succeeded by
subtle classroom management including careful
definition and negotiation of objectives, considera-
tion of student and teacher’s characteristics, of
cognitive and affective styles, and of economic and social
needs. Thanks to the advancement of developmental
and educational psychology it is now understood,
for instance, how the Piagetian constructivist theory
implies that many crucial educational objectives can
only be defined by or with the learner, while inter-
acting with his or her environment. The naive concept
of individualized teaching (see Individualized
Instruction) and the dogma of group work is replaced
by flexible group structuring and flexible scheduling.
Beyond the original model of mastery learning (see
Mastery Learning Model of Teaching and Learning)
now appears the more general concept of a school
making sensible use of time and of all human and
technological resources available. Opportunities to
learn are multiplied. The future appears to belong
to a more modular system of education. The new
perspectives opened by the computer technology are
also more clearly perceived and are probably best
illustrated by the “Logo environment” (Papert 1972),
which is a challenge to intellectual creativity and
development. These new developments, given as
examples among many others, still have to be dis-
seminated to the majority of schools, their validity
and feasibility in terms of daily practice having
been established.

6. Conclusion

Like medicine, education is an art. That is why
advances in research do not produce a science of
education, in the positivist meaning of the term, but
yield increasingly powerful scientific foundations for
practice and decision making. In this perspective,
itis can be said that from 1900 to 1980, educational
research has gathered a surprisingly large body of
knowledge containing valuable observations and
conclusions.

See also: Educational Research and Policy Making;
History of Education

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Educational Research, Information for

Information is a valuable resource which is essential to the progress of research and development. In order for information to be effectively utilized, it should be identified, managed, and disseminated in a systematic and efficient manner. Information systems have been devised to store and provide access to data. Modern computer technology together with developments in the telecommunications field have resulted in storage and retrieval services from which the user can obtain information from the computer at low cost with almost negligible delays. In this article, the transfer of education information from source to user will be discussed. Special emphasis will be given to bibliographic information services or systems which have been developed to manage the vast range of information in the field of education together with information exchange arrangements which have been established both internationally and nationally.

1. Information Transfer

Educational information or knowledge is presented in a variety of forms which can be categorized into five groups, namely "facts" which are small but true pieces of knowledge; "ideas" or perceptions of existing systems or innovations which can be creative or original as well as developmental and relevant; "methods" by which facts are collected and ideas are implemented; "frameworks" which are complex packages of ideas and methods merged together logically; and "combinations" of other knowledge types which are derived from various groupings of facts, ideas, methods, or frameworks. Information obtained from a variety of sources and can also be classified according to these sources. Havelock and Hubberman (1977) suggest at least five generic categories of sources, which include "settings," "institutions," "vendors," "knowledge storage centers," and "personal networks." Information storage is assuming greater importance with the need to control the vast quantities of available information. The 1,000 databases in the United States, 600 of which are available online (i.e., by direct interaction with the computer), are essential in managing this information. Although databases and other information services are accessible online and are of immense value, they are not without problems. The channels of communication are biased, of varying quality, and of varying reliability. The user's freedom to choose information has been limited by the medium before transmission by the recency of publication time. Table 1 lists a number of sources of education information.

The Directory of Information Sources (1983) is a guide to Research in the Netherlands. It has a database of sources which is continually updated. The directory is divided into two parts: a basic database which lists 293 data files available at educational and social science institutions, and a publication directory which lists bibliographies and directories of research institutions, publications, and online bibliographies. The directory is updated annually.

2. Information Services

The ERIC (Educational Resources Information Center) is the largest single system in education in the United States. The Office of Education in the U.S. Department of Education produces and distributes more than 2,000 bulletins annually on educational research and development. These bulletins provide a summary of the latest research findings and are available free of charge to the public. The ERIC database contains over 1,000,000 records on educational research and development, with 600,000 of these available online. The database is updated monthly and is accessible through a variety of search engines. ERIC provides a wealth of information for researchers, educators, and policymakers interested in educational research and development.