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ABSTRACT

The history of U.S. pedagogy involves episodes in which psychology and education have shared a common goal, specifically, to understand how children learn. Although the marriage between psychology and education has not always been a smooth one, in general, the effects produced by this union on education have been beneficial to children. Most instructional methods currently implemented in classrooms are predicated on constructivism because it has been proven successful in helping students learn more effectively. Although constructivism is currently popular in education, behavioral science was once touted as a medium for improving the quality of education in the United States by the scientific curriculum writers. This paper examines why the scientific curriculum writers of the early 20th century and later the President's Science Advisory Committee of 1962 (PSAC) championed the use of behavioral science in U.S. education. Before an analysis of these questions, the paper conducts a review of the historical background describing the entry of behaviorism into the pedagogical arena during the early 20th century. (Contains 46 notes.) (BT)

# Cries for Social Efficiency in the Pedagogical Arenas of the Early Twentieth Century and the Early 1960s



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*Cries for Social Efficiency in the Pedagogical Arenas*

*of the Early Twentieth Century and the Early 1960s*[1]

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The history of American pedagogy involves episodes in which psychology and education have shared a common goal, namely, to understand how children learn. Psychologists, such as Piaget and Vigotsky have helped educators understand how children learn, and dedicated educators committed to improving their teaching effectiveness have implemented this knowledge of student learning into their classrooms. Although the marriage between psychology and education has not always been a smooth one, in general, the effects produced by this union on education have been beneficial to children. Through the aid of psychology, for example, educators have learned that finding ways for motivating students to learn is more effective and more humane than the birch rod, a corporal punishment device once used by some earlier educators to compel students to work or to behave in the classroom. Also, most instructional methods implemented in today's classrooms are predicated on constructivism because it has been proven successful in helping students learn more effectively.[2] As a result, teacher education programs across the country are emphasizing how important it is for teachers to encourage children to construct their own knowledge and understanding.

Although constructivism is popular in the field of education today, behavioral science was once touted as a medium for improving the quality of education in the United States by the scientific curriculum-writers. This paper examines why the scientific curriculum-writers of the early twentieth-century and later the United States President's Science Advisory Committee of 1962 (PSAC) championed the use of behavioral science in American education. Before an

analysis of these questions begins, however, a review of the historical background describing the entry of behaviorism into the pedagogical arena during the early twentieth century is warranted.

*A Cry for Social Efficiency*

Beginning with the middle of the nineteenth century, science began making its debut into colleges and universities, and soon began impacting the academic disciplines, including the field of psychology. Accompanying this emergence of science into the academy came what David Bakan calls the "two-step" vision of scientific science. Bakan states, "the two-step vision of scientific development is that knowledge is first developed by experiment and theory, and is only subsequently applied to concrete problems."[3]

Later during the early twentieth century, science continued to impact the lives of the American people and soon the nation began responding to the effects of industrialism, namely, to the change in American social institutions. Some social scientists believed that the influence of certain social institutions such as family and church was plummeting and that in order to offset the negative consequences associated with this decline, the school had to be reorganized to address these effects. In general, the supporters of social efficiency believed that it could promote social stability in the face of the increasing demands for social change. Furthermore, they claimed that social efficiency was a science predicated upon exact measurement and precise standards, and therefore, could be used to help maintain a predictable and orderly world.

One response to this change in social institutions was a cry for social efficiency as a social ideal and as an educational doctrine. Among the Americans who argued for social change were educators who were ready and willing to embrace social efficiency. The social theory that led to the development of social efficiency educators is best represented by the work of the American sociologist, Edward A. Ross. Although Ross was not a sociologist of education by

trade, his social ideas strongly influenced the work of educational sociologists notably, Charles Ellwood, Ross Finney, Charles C. Peters and David Snedden. Ross expressed his views on education in some of his writings. He contended that children needed to be grouped in schools according to their levels of ability:

> . . .we must take more account of individual differences and make proper discriminations. School children of each year should be grouped according to mentality and the class for teaching should comprise those of about the same mental gait.[4]

The social efficiency educators argued that the scope of the curriculum needed to go beyond the teaching of reading, writing, and arithmetic. They argued that a full range of life activities needed to be incorporated into the curriculum. In short, they recommended that the content of the curriculum be altered so that a direct link between what children learned in school and the occupations that they would later engage in would be maintained. Soon, a need for curriculum writers to design programs of study that prepared students specifically and directly for their future occupations emerged within the pedagogical arena.

By 1924, Edward Lee Thorndike began making his introduction into the world of education, and soon his work in psychology was gaining popularity. Thorndike's goal was to establish a science of pedagogy from which all education could be rooted.[5] He suggested that if science was incorporated into the planning stages of curriculum development, instruction could be improved. Thorndike recommended that curriculum goals needed to be scientifically determined.[6] To accomplish this objective, he believed that methods to quantify and measure research needed to be developed. Thorndike argued that everything that exists does so in quantity, and therefore could be measured. Thorndike's call for quantifying and measuring was

popular with the scientific-curriculum writers. Like Thorndike, they argued that there was a need for designing measures that could determine mental proficiency. Soon a movement in psychology emerged, one which included the testing of intelligence. The advocates of social efficiency now argued that it was possible to standardize an individual's intellectual ability into I.Q. points. The scientific-curriculum writers seized this new development in psychology and called for a differentiated curriculum designed according to students' native capacities and that could prepare them for their future occupations. In effect, the scientific-curriculum writers were borrowing the concept called "transfer of learning" from the developing behavioral psychology. In general, this concept states that "what one learns in school somehow carries over to situations different from that particular time and that particular setting."[7]

Along with the supporters of social efficiency, Thorndike championed the need for differentiation in the curriculum, especially in the high school. He argued that schools needed to educate students according to their intellectual capabilities. Thorndike contended that those students who were not academically inclined needed to be taught skills more suited to their natural abilities.[8]

Soon the scientific curriculum-writer's definition of pedagogy, namely, that it prepared individuals for future occupations became embedded in the educational philosophy and the school curriculum began to change. For example, reading, the focus of the elementary school curriculum became the target of many scientific studies of word frequency and Thorndike's *The Teacher's Word Book (1921)* was used by many educators. Reading and arithmetic instruction was now incorporating the use of scientifically determined data.

In addition to Ross and Thorndike, another key figure who influenced the curriculum movement toward social efficiency was Frederick Winslow Taylor, sometimes referred to as the

father of scientific management. Although Taylor did not become involved with education directly, his supporters in education helped to transfer his ideas regarding the management of factories to the management of schools. According to Herbart M. Kliebard, Taylorism provided the "language and hence the conceptual apparatus by which a new and powerful approach to curriculum development would be wrought."[9] Taylor's disciples in education argued that in order to make the curriculum a direct and influential force in the lives of future citizens, and ultimately, an instrument for creating a stable and smoothly functioning society, education needed to adopt the principles of scientific management.

It was John Franklin Bobbitt, however, a scientific curriculum-writer who helped commandeer social efficiency into education. Bobbitt argued that in order to eliminate inefficiency in education, the American curriculum needed to be designed to address the different levels of natural ability.[10] He emphasized that "education is the process of preparing individuals for their adult responsibilities and activities," and "not for child life."[11] Pursuant to Bobbitt that meant that people should not be taught what they will never use and that doing so would only result in a waste of time for teachers and students. Bobbitt suggested that educators needed to apply the principles of scientific measurement and behavioral science in education in order to predict the future careers of students. That prediction he believed could then serve as the foundation of a differentiated and specialized curriculum. Bobbitt's literary works clearly reflect his fondness of a scientific approach to teaching and learning. His books are filled with a vernacular suggesting that education is both task-oriented and scientific. Words and phrases that connote a leaning toward scientific management, such as, "educational engineer," "activity analysis," "efficient citizenship," "mental efficiency," and "technology of living" are peppered throughout his writings.[12]

In addition to Bobbitt, other scientific curriculum-writers, notably, Werrett Wallace Charters were taking notice of Thorndike's work. Pursuant to Charters even moral education needed to be systematized. By doing so, he argued that the teacher could be sure that "the field has an orderly content, and that when the children have learned the material in the best pedagogical order, the whole field will have been covered."[13] By 1918, social efficiency and its leanings toward behaviorism as a curriculum theory had gained popularity and momentum, and curriculum was now being viewed as an essential domain within the broader spectrum of education.[14]

Despite the urging of a scientific blueprint for teaching and learning by the scientific-curriculum writers, however, social efficiency did not gain a monopoly over the other three groups of education reformers, namely, the humanists, the develop mentalists, and the social meliorists who were also trying to define the American curriculum. During the early twentieth century all four groups of reformers presented their platforms in the educational arena, but "in the end, what became the American curriculum was not the result of any decisive victory by any of the contending parties, but a loose, largely unarticulated, and not very tidy compromise."[15] Years later, nevertheless, the need for efficiency and the use of behavioral science in education would again be touted. The champions this time around, however, would not come from the fields of sociology or education, but would emerge from the academy of science.

*The Scientists are Coming*

During the postwar years of World War II various critics and reformers of education in the United States expressed myriad reservations regarding the quality of education the nation's youth was receiving.[16] At the time, progressive education, a philosophy that emphasized student-centered curricula and the affective needs of students dominated the educational

discourse. In essence, progressive education embraced the following tenets: personality development, creative self-expression, the needs of learners, the recognition of individual differences, intrinsic motivation, the teaching of children not subjects, real life experiences and adjusting the school to the child.[17]

Essentially, progressive education was attacked on philosophical grounds. The detractors of progressive education argued that it fostered curricular deficiencies and promoted soft and weak academic programs. Robert Hutchins, for example, an historian of American history argued that in the United States little effort was being made to raise the level of mass cultivation through the schools, and that American universities were offering programs that were irrelevant and trivial:

> So I deplore the multiplication of trivial courses, in cosmetology, fishing, and tap dancing, which swell the catalogues of great American universities and which have no purpose except to help the student wile away four years without using his mind. Think of the most futile, childish, irrelevant subject you can—think of parlor games, think of self-beautification, think of anything you like—I will undertake to find it for you among the courses offered by American institutions of higher learning.[18]

Although Hutchins' description of the quality of education in the United States is an exaggeration because many universities at the time were offering courses that followed strong liberal arts curricula, his remarks demonstrate the fervor with which many critics expressed their views. Also, many of the opponents of progressive education viewed America's educational problems against the backdrop of the Cold War as early as the late 1940s. The fact that

universities were graduating fewer students in programs of science and engineering concerned both scientists and politicians alike. As President Dwight D. Eisenhower stated:

> . . . According to my scientific advisers this is for the American people the most critical problem of all. My scientific advisers place this problem above all other immediate tasks of producing missiles, or developing new techniques in the armed services. We need scientists in the ten years ahead. They say we need them by thousands more than we are now presently planning to have. . .[19]

Moreover, the critics of progressive education claimed that by allowing students to avoid taking rigorous subjects in schools, the nation's educators were responsible for the shortage of qualified personnel in technological fields vital to national security. Many educators, of course contested the allegation vigorously. The historical literature contains many articles and commentaries devoted to challenging the critics of American education.[20]

However, on October 4, 1957 when the Soviet Union launched the world's first artificial satellite, the debate surrounding the quality of American pedagogy came to a halt. For now the critics of education had the ammunition needed to abet education reform—the Soviet Union had beaten the United States by being the first nation to have sent a satellite into outer space. As Admiral Hyman Rickover, father of the nuclear submarine stated:

> The powerful thrust of Sputnik's launching device did more than penetrate outer space. It also pierced the thick armor encasing our complacent faith in America's present and future technological supremacy. It blasted the comfortable conviction that only in an atmosphere of personal independence and political liberty can science and scientists

flourish. . .Sputnik may well be the catalyst which brings about drastic and long-overdue reforms in utilizing the nations' intellectual resources.[21]

Later, on November 3, 1957 Sputnik II was launched and on May 15, 1958 Sputnik III was launched into outer space. These subsequent launchings added to the pressure the federal government was experiencing regarding its ability to remain as a super power. Pursuant to the American public, Soviet technology had surpassed that of the United States, and the Sputnik launchings validated their concerns regarding a curricular deficiency in the schools. Up to that time in history, most Americans believed that the United States was the strongest nation in the world, and they basked in that knowledge. However, when a trio of satellites went soaring into space, America's confidence in its science program was shaken. Soviet technology had managed to shatter their self-confidence in matters of national defense and scientific supremacy. Naturally, the American public demanded answers from its leaders. However, what could their leaders say? The Soviets had beaten us.

The group that perhaps felt the most uncomfortable during the Sputnik crisis was the scientific community. To many Americans, the United Space program was the best in the world, so how could the Soviets have launched a satellite before the United States did? The clamor that ensued after the launchings of Sputnik reverberated into the living room of every American citizen. Sputnik had literally become a household word over night. Soon the political arena became the center stage for addressing the concerns of American pedagogy. Educators, scientists, and politicians soon found themselves debating over which direction the American curriculum should follow.

Although members of the scientific community had voiced concerns about the quality of education prior to 1957, it was the Sputnik launchings that brought many of them into the

political and pedagogical arenas. It was not uncommon for the scientific community to have counseled the President on pedagogical matters. In the Eisenhower administration, for example, James B. Conant, scientist and former president of Harvard University advised the President on several occasions. He did not hesitate to express his opinions concerning the administration's arguments to fortify the American educational system with regard to meeting national needs. In a letter to Governor Sherman Adams, Conant wrote:

> Secretary Folsom thought you might be interested in my reactions to his tentative program for the administration's proposals to "strengthen our educational system in its capacity to meet critical national needs". . .In general, I like the program. . .I am enthusiastic about the scheme for identifying the academically talented youth by a testing program. . .[22]

In 1957, the United States Congress conducted many hearings regarding the status of American education. Before the Senate Committee on Labor and Public Welfare of the 85th Congress, scientists were invited to give their opinions and recommendations regarding education in general, as well as on science education. When asked about his views on education before the Committee, scientist Werner von Braun stated:

> . . .I strongly believe in a well-rounded education, and I believe absolutely in the the need of stressing the humanities in early education. But I do not so much believe in all these newfangled types of things that are being taught at some schools and colleges these days, like "life adjustment" or "household economy." I think too much time is devoted to such courses.[23]

More importantly, however, the launchings of Sputnik reinforced the arguments of several key statesmen who espoused the claim that political supremacy and democracy were linked to

technological proficiency. On January 16, 1958, Secretary of State John Foster Dulles gave an address before the National Press Club: "I shall speak first about Sputnik. The launching of an earth satellite by the Soviets may mark a decisive turn in the worldwide struggle between Communist imperialism and the free world."[24] President Eisenhower went further by linking the importance of technology to United States national security:

> We in America have a unique technological ability to use science for the strengthening of our country's defense against aggression and for the application of our material resources to the improvement of human living. . .An imaginative and vigorous effort on the part of citizens' organizations and government can, I am confident, maintain for us the technological superiority upon which our economy and our national security so critically depend.[25]

*The President's Science Advisory Committees of 1959 and 1962*

Even though the clamor surrounding the Sputnik crisis had subsided to some extent in 1959, President Eisenhower still expressed an interest in strengthening our scientific and engineering manpower. He requested that the President's Science Advisory Committee of 1959 investigate the quality of science education in the country and provide suggestions for increasing the numbers of technical personnel in the United States.[26] The Committee selected a panel to oversee the report. The panel went to work and issued their findings in a report, *Education for the Age of Science*.[27]

Although the Committee's report does not discuss behavioral science, it is germane to this discussion because it was PSAC's first document aimed at improving the quality of education in this country. Moreover, *Education for the Age of Science*, expressed PSAC's interest and more importantly its willingness to enter the pedagogical arena. In general, the report

called for ameliorating the shortages of scientific manpower that were evident in the United States and urged that teachers needed to become more proficient in their respective teaching fields.

After the Eisenhower administration ended, President John F. Kennedy became this nation's leader. In 1962, the President's Science Advisory Committee, consisting of a different panel of scientists, except for four scientists who remained, maintained a continued interest in education. The Committee requested a sub panel headed by Jerome Wiesner, special assistant for science and technology, to investigate how education might be improved.[28] The sub panel conducted their study of this issue and issued a report, *Strengthening the Behavioral Sciences.*[29]

In the document the sub panel continued to express concerns regarding the shortages of scientific manpower. However, it was now linking the use of behavioral science to national security. The sub panel posited that "the general issues studied by behavioral scientists are critically important to our national welfare and security. Ways must be found to strengthen these disciplines and improve their use."[30] Moreover, in the report, the subpanel embraces the use of the behavioral sciences in improving the quality of American life and expresses its recognition of the scientific aspects surrounding the field.

> The behavioral sciences have both a fundamental and an applied aspect. As fundamental sciences they are concerned with the careful, dispassionate discovery and analysis of the basic facts of human behavior, individual, and social and with the construction, testing, and revision of theories to explain observed regularities. As applied sciences, they are concerned with the application of facts, tested theories, and developed insight to questions of practice in such areas as education, mental health, personnel utilization, city

> planning, communications, and the problems of emerging countries. Behavioral scientists use methods common to all sciences: observation, instrumentation, field and laboratory experiments, statistical analysis of data, construction of models and theories, and good, hard thinking. . .[31]

It must be noted, however, that although the sub panel exhorted the use of the behavioral sciences, it believed that it was not as exact as the other sciences in matters, such, as errors of measurement. The scientists suggested that the number of variables required to understanding the different kinds of human behavior when combined with random or uncontrolled variations accounted for the imprecise results. Nevertheless, the sub panel posited that behavioral scientists were committed to finding avenues for developing and testing significant theories.

Regarding pedagogical matters, the subpanel posited that the behavioral sciences could improve American education:

> The behavioral sciences can contribute to many problems of education, such as increasing insightful learning in the classroom and changing those strong influences from fellow students that run counter to the goals of parents and teachers. Basic research has already led to programmed learning, both by programmed texts and teaching machines.[32]

The last sentence of the paragraph, "Basic research has already led to programmed learning, both by programmed texts and teaching machines" indicates that the PSAC of 1962 was aware of the technology being advocated by the behaviorist, Burrhus Frederic Skinner and others, namely programmed instruction and teaching machines.[33] The subpanel presented their findings to PSAC and the report was published. It must be noted that John W. Tukey, a mathematician from

Princeton University served on the panel and also served on PSAC of 1962. He served as the liaison between the two groups.

After reviewing the document, it is evident that the President's Science Advisory Committee viewed behavioral science as the ticket for not only improving education, but for also refining the quality of life for all Americans. The report suggests that behavioral science needed to be used to collect and process data on other societies and cultures, and to research issues surrounding urban renewal and transportation.

Later in 1962, a third report was issued by the President's Science Advisory Committee, *Meeting Manpower Needs in Science and Technology.* This report was prepared by the PSAC panel on scientific and technical manpower.[34] This document again emphasized that impending shortages of talented, highly trained scientists, and engineers threatened the successful fulfillment of vital national commitment. In addition, the Committee urged once more that behavioral science needed to become part of the plan for solving the manpower problems.

> No recital of the human setting of science and the engineering application of discovery for man's benefit should fail to consider the study of the nature of man himself—his motives, goals, actions—as a proper and necessary area for application of methods of science. Our concern embraces the behavioral sciences. . .We are of the view that additional study by our Committee and the Federal Council for Science and Technology is necessary to understand the full scope and implications of subject matter embraced by this rubric, something of its methodology, its relationship to other disciplines, and to evaluate research and teaching goals and needs. Manpower problems and requirements will then be assessed in relation to present programs.[35]

The Committee posited that behavioral science was a discipline that could be used to improve the quality of education in this country. By creating two public documents that specifically extolled the use of behavioral science in education, the Committee was declaring its support of a scientific approach to teaching and learning.

When discussing the PSACs of 1959 and 1962, there are two points that bear noting. First, although both PSACs were composed of scientists primarily from the fields of engineering, physics, chemistry, and mathematics, the Committees welcomed the input from individuals who came from other disciplines and shared different viewpoints. The PSAC of 1962 for example, asked Ward H. Goodenough, an anthropologist, and George A. Miller a psychologist to serve on the panel that oversaw the document *Strengthening the Behavioral Sciences.* Although Miller served on this panel, he was not a behaviorist like B.F.Skinner, because he was largely responsible for "the dramatic shift away from behaviorism, which dominated the field for over thirty years, to cognitivism. . ."[36] Both PSACs wanted the "top minds" in the country to serve on the panels.

An appropriate question to ask at this juncture is "Did these reports have a significant impact on education?" After conducting a five- year investigation of teaching machines and programmed instruction in U.S. schools, the research reveals that the documents themselves did not have a major impact on the use of behavioral science in education. The reports did not influence educators to incorporate behavioral science into their teaching practices.

However, behavioral science did have an impact on education in the United States. Programmed instruction and teaching machines were utilized in some universities, secondary and elementary schools during 1960-1970.[37] The National Defense Education Act of 1958 (NDEA) , legislation passed through both Houses of Congress, as a result of the Sputnik crisis, served to

help the technology gain access into the educational arena. [38] Title VII of the NDEA of 1958 fostered the development of technology projects, including, the design and implementation of teaching machines and programmed instruction in the 1960s. Although B.F. Skinner was conducting research on a behavioral approach to teaching and learning before the launching of the first Soviet satellite, the NDEA helped to catapult his work out of the laboratory and into the educational arena. Skinner's work in the early 1960s was funded in part by Title VII of the legislation.[39] Although Skinner is the name most often associated with teaching machines in the United States, there were other behaviorists whose work received federal funding as well.

The data reveal that many schools opted to experiment with programmed instruction and teaching machines in attempts to provide better education to their students. After reviewing sixty-two studies to ascertain the effectiveness of the technology, however, the data reveal that, in general, programmed instruction was not any more or less successful than the conventional teaching practices of the 1960s, namely, textbook instruction and lectures.[40]

## Conclusion

The early twentieth century and the 1950s are two periods that substantiate the premise that political and social events do indeed impact the American curriculum. In the early twentieth century, for example, the changes fashioned by industrialism and science encouraged educators, namely, the scientific-curriculum writers to seek new avenues for teaching more efficiently. Basing their arguments on the work of Ross and others, they urged that academic content needed to exceed the traditional staples of education---reading, writing, and arithmetic. They posited that children needed to be taught the skills that they would later utilize to perform their jobs and careers effectively and efficiently. Of course this meant that the students' native capacities needed to be determined at an early age. Their critics argued that categorizing children

according to their intellectual capabilities was insensitive and dehumanizing. However, to the scientific-curriculum writers this task was an absolute necessity. In their minds, implementing a scientific approach to teaching and learning was the way to go.

Years later in the 1950s as a result of the Sputnik crisis, the American curriculum was again under attack. In general, the critics stated that students were not being sufficiently prepared to meet the needs of an increasingly scientific and technological world. To many in the scientific community, educators needed to teach students more science and mathematics and to teach these subjects more efficiently.

Soon, the pedagogical arena became the center stage for discussing in which direction the American curriculum should follow. With the Cold War as a backdrop, scientists began expressing concern over the existing shortages of scientific personnel. They believed that universities needed to produce more scientists and engineers to remain competitive with the Soviet Union. In fact, various scientists argued that the secondary education curriculum needed to include more science and mathematics instruction. Both PSACs of 1959 and 1962 shared their colleagues concern. However, the PSAC of 1962 went beyond its predecessor. In addition to stating that there was a national shortage of scientists and technical personnel, the Committee via *Strengthening the Behavioral Sciences* and *Meeting Manpower Needs in Science and Technology* suggested that behavioral science be used to help bring about a better understanding of how societies work, and how it could benefit the field of education.

Although the efforts of PSAC 1962 for promoting the use of behavioral science in education yielded minimal success, the Committee's resolve to improve the quality of education was clearly evident. The irony surrounding this endorsement of behavioral science is that in general, the Curriculum Reform Movement that transpired following the Sputnik Crisis in the

1960s touted the use of cognitive psychology and not behavioral science. Educators, for the most part, were embracing instructional methods based on discovery learning.[41]

One interesting facet surrounding the documents, *Education for the Age of Science, Strengthening the Behavioral Sciences* and *Meeting Manpower Needs in Science and Technology* is that they were written with confidence, without a hint of indecision on the part of the members of either Committee. The language used to express their ideas was direct. The Committees left little room for ambiguity. They believed that what was being recommended in those documents was the best course of action for the United States to implement at the time.

It should be surprising that the PSAC of 1962 would have endorsed behavioral science. The fact that most of the Committee members were scientists can help us understand why they selected this psychology to champion. As scientists, their work depended upon the use of exact measurement and data analyses. Although PSAC of 1962 did not find behaviorism to be as exact as the other sciences, the members could have related to the behaviorist's claims that psychology needed to be studied as a science and that behavior was lawful and could be determined.[42] Scientists, such as, James B. Conant for example, wrote to B.F. Skinner expressing an interest in his teaching machines.[43] Another key point that may explain why the Committee endorsed behavioral science is that behaviorism was the psychology more dominant at the time, and cognitive psychology was beginning to gain momentum in the field of psychology and education. However, the issue of which psychology was endorsed by PSAC of 1962 is not of major significance.

What is important is the realization that in the early 1960s science and psychology came together for a common goal, namely, to improve the quality of education, and the three PSAC reports symbolize this union. Had educators served on these Committees, education could have

been included in this merger. However, no educators served on these Committees. As a result, the voices of teachers were not heard. However, based on the documents, notably, *Education for the Age of Science*, I would argue that despite an absence of educators, the members did discuss the many duties teachers face and expressed a concern for the teaching profession. For example, in the first page of this document, President Eisenhower states:

> This report makes clear that the strengthening of science and engineering education requires the strengthening of all education. As an excellent statement of educational goals and needs, I hope it will be widely read. . .One subject discussed in the report warrants special emphasis—the importance of raising the standing of our teachers in their communities. Higher salaries are a first requirement, but we need also to recognize the great importance of what teachers do and to accord them the encouragement, understanding, and recognition which will help to make the teaching profession attractive to increasing numbers of first-rate people.[44]

A compelling feature of this particular report is the Committee's compassion for the teaching profession.

> One of our difficulties arises from the fact that we ask our teachers to do a great deal more than may be necessary. We ask them to keep order in classrooms, to inspire the students and to be their judges at one and the same time. . .We insist that they know how to teach and also that they know what to teach, although we have long been uncertain as to how much to value each of these abilities. . .This is a large order! But what do we offer in return? We are often less concerned with their successes than we are

with those of the football coach, whom we customarily pay more as well. . .

It is a small wonder that good teachers are in short supply. . .[45]

Most educators today would probably find the comments expressed by PSAC still applicable today.

The decision of the scientific-curriculum writers and PSAC to enter the pedagogical arena and to challenge the ways in which students were taught is their contribution to American history. By taking an interest in American pedagogy, these entities were demonstrating their belief that all individuals regardless of their involvement in child-related careers could be involved in matters relating to education. Although the scientific-curriculum writers were educators, per se, their views were predicated upon ideas and concepts formulated in other disciplines, namely, sociology and behavioral science. Therefore, it can be said that sociologists and behavioral scientists of the early twentieth-century played an integral role in the development of the educational philosophy espoused by the scientific-curriculum writers. With the PSACs of 1959 and 1962, the challenge to the American curriculum by career groups outside of education was more obvious. Both Committees were composed primarily of scientists and engineers, with some exceptions.

Although the need for constructivism is being taught in teacher education programs and is popular in the pedagogical arena, one persistent contribution of the scientific curriculum-writers of the early twentieth-century to education is the continued insistence upon stating precise and definite curricular objectives in advance of any educational activity. Currently, various teacher's guides and textbooks utilized by teacher educators and teachers in elementary and secondary schools provide the goals and objectives at the beginning of each lesson[46]. Also,

the scientific curriculum-writers' views on education as a means for preparing children for the future has become ingrained in contemporary educational thought.

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*Endnotes*

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[4]Edward A. Ross, *Principles of Sociology*, (New York: Century Press, 1930), 555.

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[8]Ibid., 223, 319.

[9]Ibid, 97.

[10] Franklin Bobbitt, *Curriculum Investigations,* (Chicago: University of Chicago, 1926), 2-4.

[11]Franklin Bobbitt, *How to Make a Curriculum*, (Boston: Houghton Mifflin, 1924, 8, 283.

[12] Ibid., pp. 2, 8, 20; Franklin Bobbitt, *Curriculum of Modern Education*, (New York: McGraw-Hill Book Company, 1941), 417.

[13] W.W. Charters, *The Teaching of Ideals*, (New York: The Macmillan Company, 1928), 44.

[14]Kliebard, Herbert M. *The Struggle for the American Curriculum: 1893-1958*, 115.

[15] Ibid., 29.

[16] Barbara B. Clowse, *Brainpower for the Cold War: the Sputnik Crisis and National Defense Education Act of 1958* (Westport, Connecticut: Greenwood Press, 1981), 41-43.

[17]Lawrence A. Cremin, *The Transformation of the School, Progressivism in American Education 1976-1957* (New York, Alfred A. Knopf), viii.

[18] Robert M. Hutchins, *The Conflict in Education: in a Democratic Society* (New York: Harper and Brothers, 1953), 12-13.

[19] President Dwight D. Eisenhower, "National Radio and Television Address" November 13, 1957 *Public Papers of the President,* v. 3, p. 42, Eisenhower Library, Abilene, Kansas, USA.

[20]C. Winfield Scott and Clyde M. Hill, *Public Education under Criticism* (New York: Prentice-Hall, Inc., 1954), 45.

[21] Hyman Rickover, *Education and Freedom* (New York: Dutton and Co., Inc., 1959), 157-158.

[22]James B. Conant to Governor Sherman Adams, December 2, 1957, Box 4 NN3-12-90-004 Appendix R, National Archives at College Park, MD, USA. Secretary Folsom's complete name was Marion B. Folsom.

[23] Wernher von Braun, "Statement before the U.S. Senate Committee on Labor and Public Welfare, Eighty-fifth Congress, January 23, 1958, p. 74, RG 287 Publications of the Federal Government, 74; National Archives, Washington, D.C.

[24] Secretary of State John Foster Dulles, "Statements of Prominent Americans on the Opening of the Space Age: A Chronology of Selected Statements," October 4, 1957, OS-681000-13 Sputnik (USSR), Articles 1958: The Smithsonian Air and Space Museum Archives, Washington, D.C., USA.

[25]President Dwight D. Eisenhower, "Statement by the President on Establishing the National Committee for the Development of Scientists and Engineers," *Papers of the President*, pp. 365-366; Eisenhower Library.

[26]The 1959 PSAC consisted of: Dr. Robert F. Bacher, Professor of Physics at Caltech, Dr. William O. Baker Vice President of Research at Bell Telephone Laboratories, Dr. John Bardeen, Professor of Electrical Engineering and Physics at the University of Illinois, Dr. Hans Bethe, Professor of Physics, Cornell University, Dr. Detlev W. Bronk, President of the Rockefeller Institute, Dr. Britton Chance, Director of the Johnson Foundation (Biophysics) at the

University of Pennsylvania School of Medicine, Dr. James B. Fisk, President of Bell Telephone Laboratories, Dr. George B. Kistiakowsky, professor of chemistry at Harvard University, Dr. Edwin H. Land, President of Polaroid Corporation, Dr. Emanuel R. Piore, Director of Research of International Business Machines Corporation, Dr. Edward M. Purcell, professor of physics at Harvard University, Dr. Isidor I. Rabi, professor of physics at Columbia University, Dr. H.P. Robertson, professor of physics at Caltech, Dr. Glen T. Metals at the University of Chicago, Dr. Paul A. Weiss, member and professor of the Rockefeller Institute, Dr. Jerome B. Wiesner, Director of the Research Laboratory of Electronics at MIT, and Dr. James R. Killian Jr., special assistant to the President for science and technology (Chairman.)

[27]President Science Advisory Committee of 1959, *Education for the Age of Science,* May 24, 1959 (Washington, D.C) Library of Congress, Washington, D.C., USA. The panel members consisted of Dr. John E. Burchard, Dean of the School of Humanities and Social Studies of MIT; Dr. Henry Chauncey, President of the Educational Testing Service, Dr. Caryl P. Haskins, President of the Carnegie Institution of Washington, Dr. Frederick C. Lindvall, Chairman of the Division of Engineering of Caltech, Dr. James A. Perkins, Vice President of the Carnegie Corporation, Dr. Alan T. Waterman, Director of the National Science Foundation, Dr. Dael Wolfe, Executive Officer of the American Association for the Advancement of Science, Dr. Jerrold R. Zacharias, Professor of Physics at MIT, Dr. Lee A. DuBridge, president of Caltech and chairman of the Committee. Consultants to the panel were: Dr. Harold B. Gores, President of the Educational Facilities Laboratories, Inc.,, Dr. S.C. Hollister, Dean of the College of Engineering at Cornell University, Dr. Frederick L. Hovde, President of Purdue University, Mr. Stephen White, Director of the Film Division, Educational Services Inc., and Robert M. Briber, Technical Assistant to the panel.

[28]The PSAC of 1962 consisted of : John Bardeen, professor of electrical engineering and physics of the university of Illinois, Harvey Brooks, dean of the division of engineering and applied physics at Harvard University, Paul M. Doty, professor of chemistry at Harvard University, Richard L. Garwin of the Watson Research Laboratory of Columbia University—International Business Machines, Edwin R. Gilliland, professor of chemical engineering at MIT, Donald F. Hornig, professor of chemistry at Princeton University, George B. Kistiakowsky, professor of chemistry at Harvard University, Robert F. Loeb, professor of medicine at Columbia University, Colin M. MacLeod, School of Medicine of New York University, Wolfgang K.H. Panofsky, director of the Stanford Linear Accelerator

Center of Standford University, Frank Press, Director of the Seismological Laboratory of Caltech, Edward M. Purcell, professor of physics at Harvard University, Frederick Seitz, president of the National Academy of Sciences, John W. Tukey, professor of mathematics at Princeton University, Alvin M. Weinberg, director of the Oak Ridge National Laboratory, Jerrold R. Zacharias, professor of Physics at MIT, and Jerome B. Wiesner, special assistant to the President for Science and Technology (Chairman), the White House. The four scientists who remained were: John Bardeen, George B. Kistiakowsky, Edward M. Purcell, and Jerome B. Wiesner.

[29]The members of the sub panel consisted of : Neal E. Miller, Chairman of Yale University, Kenneth E. Clark of the University of Colorado, James S. Coleman, Johns Hopkins, Leon Festinger of Stanford University, Ward H. Goodenough, University of Pennsylvania, Alexander H. Leighton of Cornell University, George A. Miller of Harvard University, Herbart A. Simon of the Carnegie Institute of Technology, and John Tukey of Princeton University. Consultants to the sub panel were: Elihu Katz of the University of Chicago, Jesse Orlansky of the Institute for Defense Analyses, and Henry W. Riecken of the National Science Foundation. The technical assistant was James B. Hartgering of the Office of the Special Assistant for Science and Technology, the White House.

[30]The President's Advisory Committee of 1962, *Strengthening the Behavioral Sciences*, April 20, 1962 (Washington, D.C) p. 1, Library of Congress.

[31]Ibid., p.1.

[32]Ibid., p. 18.

[33]Programmed instruction was content matter broken down into a sequential order of steps or frames. The material was then presented on a disk or celluloid tape and threaded into the teaching machine. A teaching machine was a device that controlled presentations of the frames, kept a record of the student's answers, attempted to evaluate, score, and reinforce correct behavior immediately either by controlling and advancing the next frame, or by displaying the correct answer. Edward B. Fry, *Teaching Machines and Programmed Instruction* (McGraw-Hill, New York, 1963), 75.

[34]The President's Science Advisory Committee of 1962 (Washington, D.C., 1962) Library of Congress. The PSAC panel on Scientific and Technical Manpower conducted the investigation for this report. The members were: Allen V. Astin, Director of the National Bureau of Standards, Homer D. Babbidge, Jr. President of the University of Connecticut, Carey Croneis, Chancellor of Rice University, J. Herbert Hollomon, Assistant Secretary for Science

and Technology, Kenneth H. Klipstein, President of the American Cyanamid Company, Geoerge S. Schairer, Vice President of Research for the Boeing Company, James A Shannon, Director of the National Institutes of Health, William Shockley, Director of the Shockley Transistor Unite of the Clevite Corporation, Frederick E. Terman, Vice president of Stanford University, John W. Tukey, professor of mathematics at Princeton University, Eric Walker, president of Pennsylvania State University, Dael Wolfe; executive officer of the American Association for the Advancement of Science, and Edwin R. Gilliland, Professor of chemical engineering at MIT (Chairman).

[35]Ibid., p. 25.

[36]William Hirst, *The Making of Cognitive Science,* (Cambridge University Press, 1988), vii.

[37]The Center for Programed Instruction, Inc., *The Use of Programed Instruction in U.S. Schools* (Washington, D.C.: U.S. Dept. of Health, Education, and Welfare, 1962), viii.

[38]The purpose behind the legislation was to improve the quality of education, namely, science and mathematics education in the United States. The NDEA was a four-year program that was expected to have cost the American taxpayers approximately one billion dollars. However, the amount exceeded that figure because some of the provisions of the Act required that states had to put up money of their own to qualify for financial assistance William S. Hoole, *The National Defense Education Act of 1958: A Brief Chronology* (Washington, D.C., 1960) NN3-12-90-004, Box 4, National Archives at College Park, MD, USA.

[39].B.F. Skinner, "Title VII, Project Number 191," *National Defense Education Act of 1958*, Grant Number 71-31-0370-051.3, (1964) Manuscripts and near-print items, Box 1, Folder: "An Analysis of the Behavioral Processes Involved in Self-Instruction with Teaching Machines" Harvard Archives, Harvard University, Cambridge, MA, USA. The Skinner Papers contain several letters written by teachers who enjoyed using the technology, as well as letters written by teachers who were critical of his work.

[40] John B. Hough, "Research Vindication for Teaching Machines," *The Phi Delta Kappan*, 42, (March 1962); Jerry E. Reed, "An Experiment Involving Use of English 2600, An Automated Instruction Text," *The Journal of Educational Research*, 55, n. 9 (June-July 1962); John B. Hough, "An Analysis of the Efficiency and Effectiveness of Selected Aspects of Machine Instruction," *The Journal of Educational Research*, 55, n. 9 (June-July 1962); C.R. Carpenter and L.P. Greenhill, *Comparative Research on Methods and Media for Presenting Programed Courses in Mathematics and English*, (University Park, PA); Robert Kellems, "A Comparative Analysis of the Effect of the Use

of a Progamed Text on Achievement and Efficiency in College Algebra," (Ph.D. diss., Indiana University, 1964); Leonard S. Blackman, Rudolph J. Capobianco and Michael J. East, *The Development and Evaluation of a Curriculum for Educable Mental Retardates Utilizing Self-Instructor Devices or Teaching Machines*, (Bordertown, NJ: Edward R. Johnstone Training and Research Center, 1964); Joseph Spagnoli, "An Experience with Programmed Materials," *The Journal of Educational Research*, 58, n. 10, (July-August 1965); William Hedges and Many Ann MacDougall, *A Comparison of Three Methods of Teaching Elementary School Science Involving Programed Learning*) Charlottesville, VA: University of Virginia, 1965).

[41]Diane Ravitch, *The Troubled Crusade: American Education 1945-1980*, (New York: Basic Books, 1983),231-232.

[42]B.F. Skinner, *Science and Human Behavior,* (New York: The Free Press, 1953).

[43] James B. Conant to B.F. Skinner, Jan. 18, 1959, The Skinner Papers, HUG (FP) 60.10 Correspondence, 1928-1979, Box 4, Folder Correspondence 1960, Harvard Archives, Harvard University.

[44] President Eisenhower, *Education for the Age of Science, v.*

[45] Ibid., p. 10.

[46]Johanna K. Lemlech, *Curriculum and Instructional Methods for the Elementary and Middle School*, 4th ed. , (New York: Merrill-Prentice Hall, 1998). The curriculum that teachers must implement in Texas, for example, is the Texas Essential Knowledge and Skills (TEKS). The curriculum consists of goals and objectives that were selected by teacher educators, secondary and elementary school teachers, and teaching consultants. Each grade level has specific objectives that must be taught.

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