

## **A Study of the Ages of Indiana Science Teachers and Their Increased Ages over an Eight Year Period (1972-73 to 1980-81)**

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### **Rationale and Source of Data for the Study**

The birthdates of all teachers in Indiana public schools are collected annually by the Division of Educational Information and Research, Indiana Department of Public Instruction, in its Report of Certified Personnel (EIR Form 2). These are regularly translated into teacher ages and are available through computer print-outs of teachers teaching various grades and subjects. Other than calculating the mean age for all teachers, all male teachers and all female teachers in each teaching assignment category, these data are usually processed no further.

During the spring of 1981, several inquiries were received concerning the projected future supply of various categories of science teachers. It was realized that for answers to these questions to have any validity, some knowledge of potential retirement curves, or age curves, of active teachers would be useful. The most recent comprehensive data relating to these curves was from the 1973 Project FUTEPS study (1). Since the teacher supply/demand picture had changed considerably in the intervening eight years, the need for updated information was readily apparent. Therefore, the Division of Educational Information and Research was requested to further process the age data in its computer file on 1980-81 teachers and provide age tabulations of teachers with various science teaching assignments. Similar tabulations were requested for all secondary (7-12) science teachers, all elementary teachers and all secondary teachers to serve as references in analyzing the status of the various science teacher population.

The Division of Educational Information and Research programmed the State computer to convert the birthdates of Indiana's public school instructional personnel into their chronological ages as of December 31, 1980 and then tabulated these ages for each requested teaching category using the Statistical Package for the Social Sciences. Initial review of these tabulations indicated that the shift in the ages of Indiana high school science teachers over the eight year period (1972-73 to 1980-81) was greater than was generally realized; therefore, a more in-depth comparison of the two sets of data was undertaken.

Since the Project FUTEPS (1972-73) teacher age data was coded into seven 5-year age brackets with open-ended brackets at either end of the age scale before being entered into the computer, the 1980-81 data was retabulated, by hand, into these same age brackets before comparisons of the two sets of age distribution curves were undertaken.

Also, in order to compare the actual number of persons with given teaching assignments in the two sets of data, one additional treatment was performed on the Project FUTEPS data. Those data had been collected by questionnaires completed by science teachers in February, March and April, 1973. Although the questionnaire was distributed to all teachers reported on the 1972-73 EIR Form 2 as having science teaching assignments, only 72% of these teachers returned questionnaires. Since no attempt was made to determine the return rate for teachers of the various science disciplines, it was assumed that the overall return rate applied to each

teacher category (e.i., Biology, Chemistry, etc.) examined. Thus, the number reporting each assignment was multiplied by a factor of 100/72 to approximate the total number of 1972-73 teachers with each teaching assignment. No attempt was made to retrieve the exact teacher assignment data from the 1972-73 EIR Form 2 reports since exact numbers were not as important as downward, or upward, trends in the number of science teachers in Indiana's public schools.

### Findings

Science teachers in the 1980-81 study were older than the rest of the secondary teachers who, in turn, were generally older than elementary teachers. The central tendencies of teachers' ages are given in Table 1 and their age distributions in Table 2.

Senior high school (grades 9-12) science teachers were older than their middle/junior high school (grades 7 & 8) counterparts. The mean ages of these two groups differed by 1.4 years, 39.5 and 38.1 respectively (Table 1). However, the entire middle half of the high school teachers appear to be 2 years older than the center 50% of the 7 & 8 grade teachers since the first quartile ages were 32 and 30 respectively, the median ages were 38 and 36 and the third quartile ages were 48 and 46. Only 4.7% of the high school teachers were 25 or younger while 6.6% of the 7 & 8 grade science teachers were in this age bracket (Table 2).

Among the high school science teachers, earth/space science teachers were the youngest with a mean age of 37.6 and a median age of 36 (Table 1). Physics and chemistry teachers were the oldest with mean ages of 40.9 and 40.7 respectively; the median age of both groups was 40. Although the measures of central tendencies indicated that the ages of biology teachers were distributed similar to the ages of all high school science teachers, an analysis of the age distributions (Table 2) indicated that the biology teachers may have been slightly older than the high school science teachers generally.

Tables 3 and 4 compare the 1980-81 teacher age data presented in Tables 1 and 2 with the most comparable data available from the 1972-73 Project FUTEPS study. Although the total number of science teachers increased from 1972-73 to 1980-81, the number teaching each specific discipline decreased. Only the number teaching general science increased.

Since the Project FUTEPS teacher age data were coded into open-ended age brackets at both ends of the age scale before being computer processed, mean ages of the 1972-73 teachers could not be accurately calculated, but median and various percentile ages could be interpolated with considerable confidence. Although teachers were younger in 1972-73 than in 1980-81, the relationships between ages of teachers of the various science disciplines had not changed. In 1972-73, middle/junior high and earth/space science teachers were the youngest science teachers, physics and chemistry teachers were the oldest and biology teacher ages were generally reflective of the ages of all high school science teachers (Table 3).

The age shift that occurred over the eight year period was greater than expected. In nearly all high school science teacher categories, the first quartile, median and third quartile ages had moved upward 5 or more years in the eight year period. The median age of physics and chemistry teachers had advanced 7 years.

The nature of these age shifts are apparent when the age distribution curves (Table 4) for the similar teacher populations during the two years are examined. In 1972-73, the modal age bracket for all populations of science teachers was the 26-30 age bracket, but by 1980-81 the mode was the 30-35 bracket for all populations ex-

TABLE 1. Comparison of Central Tendencies of 1980-81 Science Teacher Ages with Teachers Generally

Teaching Category	Number	Range	Mean	Standard Deviation	First Quartile	Median	Third Quartile
Elementary	28,694	21-76	38.8	10.9	30	36	47
All Sec.	28,620	22-72	38.7	10.5	30	36	46
Sec. Sci.	4,263	23-71	39.2	10.1	31	38	45
7-8 Science	1,744	23-68	38.1	10.2	30	36	44
9-12 Science	3,141	23-71	39.5	10.0	32	38	46
Biology	1,073	23-67	39.5	9.6	32	38	46
Chemistry	436	23-71	40.7	10.6	32	40	47
Earth/Space	172	23-68	37.6	9.0	31	36	43
Gen. Sci.	739	23-67	38.3	9.9	31	37	44
Phys., Sci.	186	23-68	39.9	10.3	32	39	46
Physics	338	23-70	40.9	10.1	34	40	48

TABLE 2. Age of Science Teachers 1980-81

Teacher Category	Grades	Nt	25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	60
General Science	9-12	N	45	139	156	135	96	63	48	41	16
	%		6.1	18.8	21.1	18.3	13.0	8.5	6.5	5.5	2.2
Biology	9-12	N	35	167	224	197	176	109	83	52	26
	%		3.6	15.6	20.9	18.3	16.4	10.2	7.7	3.9	2.4
Chemistry	9-12	N	22	63	68	84	80	33	23	46	17
	%		5.0	14.5	15.6	19.3	18.3	7.6	5.3	10.5	2.9

TABLE 2.—Continued

Earth/Space Science	9-12	N	172	9	29	45	37	24	9	10	5	4
		%		5.3	16.9	26.2	21.5	13.9	5.3	5.8	2.9	2.3
Physical Science	9-12	N	186	10	27	36	33	29	17	16	11	7
		%		5.4	15.5	19.3	17.8	15.6	9.1	8.6	5.9	3.8
Physics	9-12	N	338	15	39	60	66	56	35	29	29	12
		%		4.4	11.6	17.7	19.6	16.5	10.4	8.6	7.6	3.6
All Science	9-12	N	3141	148	487	625	596	488	289	224	194	90
		%		4.7	15.5	19.9	19.0	15.5	9.2	7.2	6.1	2.9
General Science	7&8	N	1399	86	285	294	255	153	108	92	87	39
		%		6.1	20.4	21.0	18.3	10.9	7.7	6.6	6.2	2.8
Life Science	7&8	N	126	6	28	29	23	12	8	11	8	0
		%		4.8	22.2	23.0	18.0	10.3	6.3	8.8	6.3	0.0
Earth/Space Science	7&8	N	43	4	10	14	6	2	22	2	1	
		%		9.3	23.3	32.5	14.0	4.6	4.7	4.6	4.7	2.3
Physical Science	7&8	N	124	14	24	25	20	17	5	6	9	5
		%		11.3	19.3	20.2	16.1	13.7	4.1	4.8	7.3	3.2
All Science	7&8	N	1744	115	358	370	319	190	125	115	107	45
		%		6.6	20.5	21.2	18.3	10.9	7.2	6.6	6.1	2.6
All Science	7-12	N	4263	222	703	865	803	608	377	294	265	126
		%		5.2	16.2	20.3	18.8	14.3	8.8	6.9	6.2	3.0
All Secondary	7-12	%	28620	6.5	18.6	22.0	16.2	11.5	8.4	7.3	6.2	3.3
All Elementary	1-6	%	28694	6.5	20.3	21.2	14.1	10.9	9.0	8.0	5.6	4.4

TABLE 3 Comparison of Median, Quartile, and 90th and 95th Percentile Ages of Science Teachers in 1980-81 with those in 1972-73

Teaching Category	Grade	Year	Number	First Quartile	Median	Third Quartile	90th Percentile	95th Percentile
Secondary Science		1980-81	4,263	31	38	45	55	59
		1972-73**	3,236*	27	32	42	52	57
Middle School Science	7&8	1980-81	1,744	30	36	44	55	58
		1972-73**	1,567*	25	30	40	52	56
High School Science	9-12	1980-81	3,141	32	38	46	55	58
		1972-73**	1,975*	27	33	42	53	57
Biology & Life Science	7&8	1980-81	126	30	35	42	53	57
	9-12	1980-81	1,073	32	38	46	54	58
Chemistry		1972-73	1,250	27	33	41	52	57
		1980-81	436	32	40	47	57	60
Earth/Space Science	7&8	1972-73	599*	28	33	45	52	58
	9-12	1980-81	43	29	33	38	52	57
General Science	7&8	1980-81	172	31	36	43	51	56
		1972-73	344*	26	30	38	51	57
Physical Science	7&8	1980-81	1,399	30	36	45	55	58
	9-12	1980-81	739	31	37	44	54	58
Physics		1972-73	1,226*	25	29	38	51	56
		1980-81	124	30	35	45	57	59
Physics	7&8	1980-81	186	32	39	46	55	59
	9-12	1972-73	633*	26	31	43	53	58
Physics		1980-81	338	34	40	48	56	60
		1972-73	456*	28	33	43	53	61

\*Number of 1972-73 teachers in each category are calculated numbers on the basis of a 72% overall response and an even distribution of responses among all categories.

\*\*The Project FUTEPS population was divided by the teachers reporting their teaching assignments in middle/junior high school or senior high school; thus, middle school data may include 6th grade teachers and the high school data may not include all 9th grade teachers.

TABLE 4. Comparison of Science Teachers' Ages in 1980-81 and 1972-73 by Percent in 5 Year Age Groupings

Teaching Category	Year*	25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	60	Mode
Secondary Science	1980	5.2	16.2	20.3	18.8	14.3	8.8	6.9	6.2	3.0	31-35
	1973	19.4	26.2	16.6	10.1	7.7	7.4	6.0	3.6	2.6	26-30
Middle School Science	1980	6.6	20.5	21.2	18.3	10.9	7.2	6.6	6.1	2.6	31-35
	1973	25.1	27.7	13.2	9.5	6.0	7.0	5.8	3.0	2.7	26-30
High School Science	1980	4.7	15.5	19.9	19.0	15.5	9.2	7.2	6.1	2.9	31-35
	1973	19.4	26.2	16.6	10.1	7.7	7.4	6.0	3.6	2.6	26-30
Biology/Life Science	1980	3.4	15.4	21.1	18.3	15.7	9.8	7.8	5.0	2.2	31-35
	1973	15.8	26.0	18.6	12.9	8.5	6.6	5.2	3.5	2.9	26-30
Chemistry	1980	5.0	14.5	15.6	19.3	18.3	7.6	5.3	10.5	2.9	36-40
	1973	15.8	24.1	18.1	7.9	9.3	10.0	7.6	3.7	3.5	26-30
Earth/Space Science	1980	6.0	18.1	27.4	19.1	12.1	5.1	5.6	3.3	2.3	31-35
	1973	23.0	30.6	15.8	8.0	5.7	6.4	4.9	1.9	3.7	26-30
General Science	1980	6.1	19.8	21.0	18.2	11.6	8.0	6.5	6.0	2.6	31-35
	1973	26.4	28.3	13.5	9.1	5.5	6.7	5.5	3.3	1.8	26-30
Physical Science	1980	7.7	16.8	19.7	17.1	14.8	7.1	7.1	6.5	3.5	31-35
	1973	20.8	26.6	16.4	7.4	8.0	7.9	5.7	3.7	3.5	26-30
-Physics	1980	4.4	11.6	17.7	19.6	16.5	10.4	8.6	7.6	3.6	36-40
	1973	13.4	22.6	20.2	11.8	9.7	9.6	5.3	2.8	5.5	26-30

\* Ages of teachers for the 1980-81 school year were computer calculated as of December 31, 1980 from reported birthdates on EIR forms while 1972-73 ages were teacher reported ages on the Project FUTEPS survey forms in February, March and April, 1973.

cept chemistry and physics teachers, where the mode had advanced to the 36-40 age bracket. In 1972-73, the under 25 year old bracket, which essentially includes only ages 23 through 25, was the second most populated age group for most science teacher categories. In all cases, at least 15% of the teachers were in this group. In 1980-81, the 36-40 age bracket was usually the second most populated. In no case were more than 8% of the teachers of age 25 and under; less than 5% of the biology, chemistry and physics teachers were in this age bracket. In 1972-73, the percent of science teachers who were 30 or younger ranged from a low of 36% for physics teachers to nearly 55% for general science teachers. In 1980-81, the range for this age group was from 16% for physics teachers to only 27% for middle/junior high school science teachers.

Special attention needs to be given to the chemistry teacher age distribution curves. There was an apparent anomaly in the 1972-73 ages of these teachers. While all other science teacher age curves appeared to peak with the 25-30 age bracket and then fairly closely follow a normal decay curve until retirement age was reached, the chemistry teacher curve dropped more rapidly at first and then rose to a secondary peak at the 46-50 age bracket. Since the 1980-81 data was inclusive of all public school teachers, it was clear that the anomaly was real and not attributable to any sampling error in the Project FUTEPS study as there was a definite secondary mode for the 56-60 age bracket. To see the exact nature of this anomaly, the precise ages of 1980-81 chemistry teachers need to be examined. (See Table 5) From this data, it is seen that 51 (11.6%) of the 1980-81 chemistry teachers were between 56 and 61 inclusive; 12 (2.8%) more were 62 and older; thus 63 (14.4%) of Indiana's chemistry teachers were 56 years old or older, while only 47 (10.8%) were between 47 and 55 inclusive.

### Discussion

The age composition of Indiana science faculties is different than it was a decade ago and the age shift may be greater than many may have suspected. The currency of teachers' scientific knowledge and their receptivity to instructional innovations may be dramatically affected by this age shift. The implications of these side effects of increased teacher age for inservice programs presents several interesting challenges to agencies and institutions having responsibility for pro-

TABLE 5. *Tabulation of Ages of Chemistry Teachers as of December 31, 1980*

Age	23	24	25	26	27	28	29
Number	4	5	13	3	16	14	16
Age	30	31	32	33	34	35	36
Number	14	14	12	17	9	16	14
Age	38	39	40	41	42	43	44
Number	18	13	23	23	17	13	12
Age	46	47	48	49	50	51	52
Number	9	4	9	2	9	4	3
Age	54	55	56	57	58	59	60
Number	7	2	12	8	9	5	12
Age	62	63	64	65	66	67	68
Number	1	3	3	2	0	1	0
Age	70	71					
Number	1	1					
Total 436							

viding teacher education. Most of today's science teachers have professionalized their certification; consequently, they no longer return to the college campuses for additional training. Those interested in the quality of school science instruction need to consider what effect these factors have on the flow of information into the public schools or on teacher exposure to new or innovative science curriculums.

Since one half of today's science teachers are essentially forty or older, what types of inservice programs will be attractive to them? One prominent Indiana social studies educator recently indicated he has to design programs for elementary and secondary students and get the teachers to come along as chaperones in order to secure their attendance at his inservice programs. Is the need for this arrangement a reflection of the economy as he inferred, or is it a result of an increased population of older teachers who are no longer as anxious as they once were to gain new knowledge? Even when they attend conventions and other functions where new and innovative ideas flow rather freely, are the teachers there to gather ideas which they can use to improve the science instruction or to visit with old friends?

The findings of this study definitely indicate that scientists and college science educators need to consider what kinds of programs will draw older teachers when they are contemplating how they might be of service in improving the quality of the elementary and secondary science programs.

The chemistry teacher age anomaly demands even greater attention by teacher educators. Since 14.4% of the chemistry teachers were 56 years old or older as of December 31, 1980, one-seventh of the 1980-81 chemistry teachers will have passed the traditional 66 year old retirement age by the beginning of the 1991-92 school year. This is the year when the leading edge of the new baby boom will enter the eleventh grade and take chemistry. Table 6 reports national data on live births from 1973, the year when the birth rate bottomed-out, through 1980. These data show that after stutter steps in 1974 & 1975, the birth rate began a continued upward climb in 1976. These 1976 babies entered the first grade in this fall (1981-82) and will enter the eleventh grade in the fall of 1991. If only one-fourth of them desire to take chemistry (about the current level of chemistry enrollment), will there be enough teachers to teach them?

Since it is now possible for teachers to retire early without too severe a penalty, many of the 51 chemistry teachers who are between 56 and 61 years old will be retiring in the next five years. Other younger chemistry teachers will leave the profession for more attractive positions in industry or for positions in school administration. From where is Indiana going to get the needed chemistry teacher replacements during the next decade?

TABLE 6 *Number of Live Births in U.S. Per Population Reference Bureau*

Year	Births	% Increase	% Increase over 1973
1973	3,137,000		
1974	3,160,000	0.7	0.7
1975	3,144,000	-0.5	0.2
1976	3,168,000	0.8	1.0
1977	3,327,000	5.0	6.1
1978	3,333,000	1.9	6.2
1979	3,473,000	4.2	10.7
1980	3,598,000	3.5	14.7

Is the Indiana chemistry teacher anomaly a nationwide phenomenon? In conversations with national researchers, this investigator has not been able to locate another study which has identified this specific problem; however, most published studies have dealt with broad age groups which may have masked-out this particular anomaly. Since there is a shortage of science and mathematics teachers nationwide, Indiana is not likely to obtain replacements from out-of-state chemistry teachers even if this anomaly is only a local phenomenon. Although about a dozen chemistry teachers are being prepared each year statewide, only one half of them find their way to the chemistry classroom; therefore, Indiana is not now training enough new chemistry teachers to meet its immediate needs.

What are some other possibilities? How many of the younger middle/junior high science teachers have a chemistry certification which they are not currently using? Are there similarly prepared teachers in the increased number of general science teachers? How many more of these two groups would be willing to take the additional training needed to become qualified chemistry teachers? How many RIFed [reduction in force] engineers and scientists would be willing to seek teacher certification? All of these questions need investigation. If either or both of the last two groups prove to be feasible sources from which to replenish the State's chemistry teaching force, Indiana colleges should immediately undertake the design and implementation of attractive retreading programs for these persons.

In summary, this study indicates that declining enrollments and widening differentials between teacher and industrial salaries have drastically reduced the number of young persons who have entered the science teaching profession during the last decade. The situation has now reached a point where it can dramatically affect the currency of the science instruction provided Indiana youth; a point where chemistry instruction in Indiana will soon be really hurting if something is not done almost immediately to reverse current trends.

#### Literature Cited

1. COLGLAZIER, JERRY M., JAMES MODENA and JERRY J. NISBET. 1974, Project FUTEPS—A Status Study of Science Teaching in Indiana. *Pro. Ind. Aca. Sci.* 83: 424-428.