Curriculum Units by Fellows of the Yale-New Haven Teachers Institute
1986 Volume V: The Measurement of Adolescents, II

Measurements of Two Adolescent Groups

Curriculum Unit 86.05.02
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“The measurement of statistics can intrigue students when the subject is themselves and the measurements and statistics obtained concern subjects which interest them” was the claim I made at the start of the paper done last year in the Statistics I Seminar at the Yale-New Haven Teachers’ Institute. I became intrigued with the study too, and so this paper is a follow up and comparison with the measurement and statistics of pregnant adolescent students at the Polly T. McCabe Center in 1984-1985. In order to broaden this unit and make it applicable to students in other schools, lesson plans are again included using some of the methods and theories learned in the Statistics Seminar. Most of these plans were “tried out” by the Biology and Physical Science students at the McCabe Center.

The main objective of this unit is to use statistical methods to try to get a clearer picture of the size, scope, and perhaps changing patterns concerning the problem of teenage pregnancy in New Haven. Beside measuring geographical location, age, and grade placement of the students, surveys were filled out by the students and analyzed in order to understand the viewpoints of the teenagers directly involved in the problems of pregnancy and the nurturing and care of a baby, while continuing their education. The second objective is to use the lesson plans to integrate statistics into the science classroom, with students measuring, calculating, graphing, and making sense of their findings.

The student enrollment at Polly T. McCabe Center for 1985-1986 was 200. This is almost the same enrollment as the preceding year when the number of students was 206.

The graphs and maps for the statistical comparison study done at the McCabe Center are at the end of this section. The issue of geographical location of students was of particular interest this year because of the relocation of the McCabe Center in September, 1985. After nineteen years at 111 Whalley Avenue, the McCabe Center moved to a renovated facility at 390 Columbus Avenue, adjacent to the Hill Health Center. By comparing the two maps, one can see at a glance that there is a heavier concentration of students living in the arbitrarily designated circle called Area I in 1985-1986.

The McCabe Center move to the center of Area I for the 1985-1986 school year may account for some of the increase of numbers of students in this area. The calculated 14% increase in Area I could mean that students who might ordinarily drop out because of the pregnancy have decided to attend McCabe Center because of the convenient location. However, without an exhaustive follow up on this data, one cannot assess the real cause, or causes, of this 14% increase. It could simply mean that there has been an increase in the rate of

teenage pregnancy in this area. Of course, the many causative factors that might cause a rate increase could also be studied. The other areas of the map for 1985-1986 show only a slight decrease of 1%, 2%, or 3% from the previous year, except for Area VI which showed a slightly larger decrease of 6% student concentration from the previous year. This may not be significant, or there may be some transportation problem involved, since Area VI represents the outlying areas of the city. (See Graph I)

The comparison of the age distribution of the two groups from 1984-1985 and 1985-1986 showed very little difference. The average age of the 206 students in 1984-1985 was 15.81. This was calculated by adding all the ages and dividing by the number of students. ( ) In 1985-1986 the average age of the students was 15.91. When one looks at Graph #2, the difference that does exist is apparent because the 1984-1985 graph is more dispersed or spread out on both sides of the mean, while the 1985-1986 curve has lost the extreme values at each end (age 11 and age 20) that were present in the previous year, and shows less dispersion and a higher peak at the mean. These facts are shown mathematically by calculating and charting the standard deviation from the mean which is 1.63 in 1984-1985, and 1.37 in 1985-1986. However, the average ages are so close, and the dispersion of the curve so close too that one cannot make any inferences concerning statistical differences in these two populations. But there was a percentage drop in students under fifteen years of age from 19% in 1984-1985 to 15% in 1985-1986. Hopefully, this would be the very beginning of a trend in this direction. However, the T test, which proves the validity of differences between two populations, showed that there was no statistical difference between these two groups.

The comparison of grade distribution in the school between 1984-1985 and 1985-1986 was also quite similar, as one might expect because of the close correlation in ages between the two groups. However, Graph III shows the high point of each graph in a different grade. The grade that has the greatest number of students (the mode) is the ninth grade in 1984-1985. In 1985-1986, the mode has shifted to the tenth grade. This probably means that there were fewer students repeating the ninth grade, since the ages of the two groups are approximately the same.

Graph IV represents the numbers of students who were enrolled in various high schools or middle schools before entering Polly T. McCabe Center. The years 1984-1985 and 1985-1986 are again contrasted on the bar graph. It is difficult to interpret the change in numbers in the three major high schools because Lee High School had already phased out some of its programs and these students had gone to the other high schools. In the middle schools there was little change within each school, but there was a total drop from 25 students in 1984-1985 to 18 students in 1985-1986.

One statistic not studied in 1984-1985, but studied this year, was the place where students received pre-natal care. Approximately 44% of the students used the clinic at Yale New Haven Hospital, 23% used Hill Health Center, 11% used the Hospital of St. Raphael, 9% used Community Health Care Plan, 7% used private physicians, 6% used Fair Haven Community Health Clinic, and some students used various other places. The emphasis on pre-natal care is important to the young mothers and the babies. In a study by Ooms, about 10% of the teenagers with pre-natal care gave birth to low birth rate babies “and of the teenage mothers with no prenatal care, 26% had low birthweight infants”. In the study done at McCabe last year on 118 babies, only 10.1% of the adolescent mothers had a low birthweight newborn. (below 5.5 lbs.)

One of the methods for preventing teenage pregnancy that is often mentioned is the teaching of sex education in the schools. Fifty-nine students at Polly T. McCabe Center participated in a survey designed and given by Lillian Townsend, a staff member at the school. Some sex education is taught in some of the New Haven schools where it is called Family Life Education. In the unsigned surveys, 95% of the students said that

they would want their children to have Family Life Education courses when they are in school. Five percent were undecided, and nobody said no. 86% thought boys and girls should take the classes together. 88% thought that parents should be notified that the classes were being taught, but only 60% thought the parents should be able to attend a class. 78% thought that parents should not be allowed to keep the child from attending the classes. Most thought the classes should begin in the middle schools. 17% thought 5th grade would be the best grade to start. Family Life Education could include not only sex education but also decision making skills that would be so helpful to the pre-adolescent and the adolescent.

Child care is of great concern to the adolescent mother and is necessary if she is to continue her education. A sample Child Care Survey which 1 wrote and gave to 43 students is included with a bar graph of some of the results. The first nine questions were only answered by the students who had already had their babies. The 23 students who were still pregnant only answered question 10. Some of the students wrote in answers on the back of the paper when asked in question 10 about an ideal plan for child care while they are in school. Most of the students said they needed someone they trusted, and most said they already had found someone to be trusted and take care of the baby the same way they would. For example: “I want someone to take care of him like I do. I feed him, I talk to him, I bathe him, I play with him.” This year, for the first time, eight students from Polly T. McCabe Center are able to bring their babies to the Mary Sherlock Day Care Center which is adjacent to the school. These young mothers are able to see their babies during the school day. There is, however, only the limited number of babies that can be cared for, because this Day Care Center also serves the surrounding community.

More emphasis has been placed this year on the role of the male in preventing teenage pregnancy. There have been talks in the schools, posters and other publicity involving the males more in the decision making process of this problem. In a survey that 27 McCabe students participated in called “The Teen Fathers Needs Assessment”, the emphasis was on involving the baby’s father in a job training program. According to the results of the survey, 33% of the fathers were still in school. 67% of the young mothers thought the baby’s father might be interested in a job training program.

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Lesson Plans

The following lesson plans are designed to be used in the science class in conjunction with the subject matter being studied. The main aim is to make the student feel comfortable with measurement, compilation of numbers, graphing, and looking at the results of the graph for interpretation. The techniques learned in math classes are easily carried over to science classes where the student can work with applications of the skills he has been taught. Practice in graph interpretation can also carry over to other subjects and areas. Emphasizing statistical concepts such as the average or mean, the normal distribution, and probability are a few of the ideas that are presented in these lesson plans.

Lesson Plan 1: *Measurement is Approximate*

Purpose:	To show students that measurement is approximate and show the variability of measurements obtained from each member of the class measuring only one sample. The graphing of the answers should produce a normally distributed histogram or curve which will be graphed. A similar experiment by J. S. Hunter, from an article in Science, "The National System of Scientific Measurement", of one blood sample sent to 100 laboratories, showed the variability of lead concentration that was found by the different laboratories from the same sample.
Materials:	A lima bean and a metric ruler that each student has access to. NOTE: A maple leaf, pine needle, or any other biological specimen may be used instead of a lima bean.
Method:	1. Give out a paper with various length labelled lines, so you are sure each student can measure a line using metric scale.
	Example: (Have unlabelled line to check measure.)

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2. Have each student measure a sample lima bean length wise at its longest point, and pass this one sample around room. Ask each student to write down his answer on a little slip of unsigned paper and to hand in.

3. The teacher can collect papers, and the next day post the cumulative results on the board from which the class can make a histogram.

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Lesson Plan II: *Variability of Size Within One Type of Seed*

Purpose:	The purpose of this lesson is to show students that not only different measurements on one sample may vary, but the sizes of one type of biological entity such as a leaf, a seed, a human being, may vary when numbers of the sample are measured. So, human beings or lima beans come in different sizes, but all within certain normal limits, and the graphing of many measurements leads to a normal distribution curve or histogram that shows the range and the average or mean measurement.
Materials:	1. A box of dry lima beans, all of approximately the same size, from which 5 will be given to each student.
	2. A metric ruler
	3. Paper to record the size in cm. of each of the 5 beans, measured lengthwise through the longest distance.
Method:	1. Have students recheck Lesson Plan I so they are sure of measuring (in cm.) standard size lines.
	2. Give each student 5 lima beans and a metric ruler.

3. Have the students record these 5 measurements on a piece of paper.

4. Collect all the papers, and either compile the class results to post on the board for the next day's graphing, or let the students help in putting all the results together.

5. Give out graph paper and help the students to graph the results from the data on the board.

NOTE: Also have students hand in their height, so a histogram of class height can be made.

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Lesson Plan III: *Measuring and Graphing Rate of Growth*

Purpose: To see that growth rate is not always linear, but often takes place in spurts. To see that growth can be influenced by other factors, for example, half the experimental seeds will be kept in the dark.

Materials: 1. lima beans

2. transparent plastic drinking cups

3. towel paper

NOTE: This experiment could also be done using soil to plant the lima beans, and watching and measuring their rapid rate of growth, but the plastic cups were chosen just so the student could see the first development that happens before the plant appears through the soil.

Method: 1. Have each student take a plastic transparent cup and line it with wet paper towel that is pressed all around the inside of cup.

2. Give the students about 5 seeds each, which have been soaking overnight in water. Ask student to label cup with name.

3. Then each student will tuck the seed inside the paper towel and pressed against the transparent cup, so it can be viewed and is held in place by the wet towel. (Sprinkle water on the towel if it dries up during the week.)

4. Invert cup so the moisture will mostly be held inside the cup.

5. Put in a place near a window.

6. Repeat experiment, but this time put the seeds in a dark place, such as a cabinet.

7. Each day have students record observations, and measure approximately the growth they see as the seed germinates.

8. Pool class results and graph.

NOTE: The experiment usually lasts only about a week because the wet paper towel starts to mold. If the seeds are planted a few cm. beneath soil they can be followed a much longer period of time.

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Discussion: This type of study can also be done when biology students are studying reproduction. The size of the embryo and fetus is given in most biology books, and the rate of growth could easily be plotted using a curve or histogram. Also, highlight events happening at the same time as growth could be written directly on the graph, such as 4 months—the skin of the fetus is well formed. The heartbeat can be heard with a stethoscope. The students in the biology classes at McCabe Center enjoyed making this type of colorful histogram.

Lesson Plan IV: *Measurement of Heart Rate Before and After Exercise*

Purpose: To graph two distribution curves on the same graph as the pulse rate of the class with a normal distribution is graphed next to the higher rates of the pulses of the class after exercise, but still containing a normal distribution. These two groups would be interesting to compare, using a t test but the scope of this type of study would perhaps be better suited to a math class.

Materials: Clock or watch with a second hand.

Method: 1. Have students seated and resting.

2. Have them practice taking their own pulses with 1st, 2nd, and 3rd fingers lightly pressing the under side of the wrist near the thumb, or on neck.

3. Time for 30 seconds and multiply by 2 to get pulse rate. Repeat a few times, check answer with previous answer, to make sure the students feel they are getting accurate counts. Repeat a third time, but this time ask the students to record the number on a paper in a table. (See example below.)

4. Ask the students to walk, or jog, in place, for 2 minutes.

5. After the 2 minutes, quickly repeat the pulse, taking procedure while standing.

6. Have students record results in the table.

7. The teacher can then collect papers, and post results on board. Students can help with the class tally. (See example.)

8. Graph results of pulse when sitting to get histogram or curve, then graph results after class exercised to get histogram, or curve. Do on same graph.

NOTE: The variations within certain limits should be discussed with the class so nobody worries about the variety of pulse rates obtained. Many variables could be added to this experiment. The average pulse rate of females is supposed to be slightly faster (by about 7 beats) than the average pulse rate of males. This would be fun to check in a laboratory lesson such as the above plan.

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Lesson Plan V:

Purpose:	To see that if enough cases are studied, one has about a 50% chance of either having a girl or boy. The probability is 0.5. The empirical data gathered shows this is a little off because there are more boys born in this country every year, but this adjusted value is very close to 0.5. The main purpose of this exercise is to show the biology student that all eggs contain the X sex chromosome, and half of all the sperm contain the X chromosome, and the other half contain the Y sex chromosome. So the egg has a 50-50 chance of being fertilized by an X chromosome and producing a girl (XX) or fertilized by a Y chromosome and producing a boy (XY).
Materials:	1. a can of 50 pennies, half marked with a small X label, and half marked with a small Y label. This represents the sperm.
	2. a cardboard circle put on the desk of each student with an X label. This represents the egg.
Procedure:	1. Each student is told they will have 10 children, and the sex of the child will be determined by the sperm.
	2. Shake up the can of pennies, representing the sperm, and the student will take one without looking, then mark down XX-girl if she picks a X penny, and XY-boy if she picks a Y penny.
	3. Then she replaces the penny in the can, shakes the pennies to mix them, and draws again from this sperm bank.
	4. After everyone has had 10 draws, the results are tabulated on the board.

Example:	BOYS	GIRLS
Student 1	7	3
Student 2	4	6
Student 3	5	5
Student 4	6	4

etc.

The results can be graphed by placing number of students on the Y axis, and *either* boys *or* girls on the X axis. The columns could also be added to see if one approaches the same number of boy babies as girl babies.

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