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Do smaller classes mean greater academic achievement in high school biology classes?

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DO SMALLER CLASSES MEAN GREATER ACADEMIC ACHIEVEMENT IN HIGH SCHOOL BIOLOGY CLASSES ?

by
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ABSTRACT

Elaine M. Awalt
Do Smaller Classes Mean Greater Academic
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Dr. Richard Meagher
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The purpose of this study was to determine if students in small classes would show greater academic achievement in high school biology classes. The study involved two high school biology classes, one with an enrollment of 20 students, and one with an enrollment of 25 students. Both groups of students were given pre-tests on the subject of invertebrates. A four week study of this topic followed. Teaching techniques and assignments were identical for the two groups. At the end of the four week study a post-test was given to all students.

The results of the pre and post-test were then analyzed using both one and two tailed independent t-tests. The results of these tests showed that there was no significant difference between the two groups.

MINI-ABSTRACT

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CHAPTER I
INTRODUCTION

Among the many techniques that have been designed over the years to improve education, decreasing class size has always met with controversy whenever it is mentioned. Teachers have always felt that it is more difficult to work when confronted with large numbers of students. They have been frustrated by the failure of research to confirm what they feel is so obvious.(Smith 1990) The controversy arises when the actual academic achievement of the students is discussed. Do large classes actually decrease the academic achievement of the student, or does it just make teaching harder work ?

Teachers believe that personal relationships with individual students can lead to creating an atmosphere of trust and higher learning. They also feel that less class time is spent on discipline, therefore creating more learning time for the students. (Phuong 1996) Although most teachers will agree that reducing class size is only one part in improving learning. Good teaching, parent participation and a strong curriculum are also essential. (Phuong 1996) Administrators worry about the cost . They feel that reducing class size is an expensive endeavor and, despite the claims of enthusiasts, the benefits of this strategy are uncertain. (Tomlinson 1988)

CHAPTER II
REVIEW OF THE LITERATURE

If anything about education has ever seemed self-evident, it is that smaller classes mean better teaching, and, consequently, more learning. That a relationship exists between class size and student achievement is a virtually unchallenged premise. Arguments about class size and it's relationship to the intellectual and social growth of children have been heard since the Ancient Greeks. (Tomlinson 1988) Among the many techniques designed to improve education, however, decreasing class size has remained one of the most controversial.

Teachers have lauded the benefits of smaller classes for many years. Administrators have demonstrated their higher cost. It is because of the potential higher cost of decreasing class size, that policymakers have demanded that it be justified on the basis of increased achievement. Yet researchers have, through many studies, been unable to resolve the controversy by providing an unequivocal answer to the class-size question. (Smith and Glass 1980)

One thing that continues to fuel the controversy is the fact that educators feel that improved academic achievement is not the only justification for decreasing class size. Teachers would argue that achievement is not even the best criterion for judging the value of decreasing class size. After all it is not class size which affects achievement, but the intellectual abilities of the student. Achievement is also a direct reflection of the levels of effort as well as the classroom processes to which the students are exposed. More directly affected by class size, are the opportunities the teacher has for trying different things. The environment and teaching process afforded by smaller classes may produce, in turn, higher achievement. (Smith and Glass 1980)

Educators initial interest in smaller classes came about as a result of a 1978 meta-analysis of research on the topic, conducted by Gene V. Glass and Mary Lee Smith. They found small improvements when class size fell to about 15. They found accelerated achievement as class size fell below this point. This makes certain intuitive sense when one considers the ultimate reduction in class size: a one on one tutoring situation. In the achievement study it was shown that more than 30 percentile ranks exist between the achievement of a pupil taught individually and a pupil taught in a class of 40. (Bracey 1995)

While the Glass and Smith meta-analysis has received strong criticism, other analyses have also turned up at least conditional support for the notion that small class size improves achievement in reading and math, especially in the early years. Yet for every study that shows a positive increase when class size is decreased, there was another study that would show the opposite.
(Bracey 1995)

Teachers have been frustrated by this lack of confirmation from the research. They feel that it is more difficult to work when confronted with greater numbers of students. The range of possible teaching techniques is restricted in large classes. Discipline problems occur more regularly in large classes. It is harder to get to know individual students in large classes. But do these problems decrease the students actual academic achievement, or do they just make the teacher's job harder? (Smith and Glass 1980) Teachers argue that making the teacher's job harder will have a negative effect on the student. If the teacher becomes less effective, the students will learn less.

Some administrators believe that improving the teacher's instructional competence will not only lighten their workload, but help them to perform more effectively. (Tomlinson 1988) Since administrators believe that learning depends on instructional quality, improving teacher competence will raise student achievement. Strengthening instructional competence is also consistent with the trend to professionalism and with the creation of the National Board for Professional Teaching Standards. Enhancing the status and image of teachers by improving their ability to meet higher standards of competence will produce greater educational returns for all parties than will costly strategies to reduce workload by reducing the size of the task. (Tomlinson 1988)

It would seem that administrators and teachers are on opposite sides of this controversial debate. There are some examples, however, where administrators and teachers worked together to try to find the answer to the class size problem. One such example involves a teacher from East Harlem. In 1974, a reform-minded superintendent, Anthony Alvarado, offered one of his teachers, Deborah Meier, the chance to start her own school. (Mosle 1996) The nuts and bolts of Meier's program were small classes in small schools. Teachers and principals get to design their own curricula, classes are small enough so that teachers can teach, and schools are small enough that no student gets "lost" in the system. Teachers are able to actively engage their students individually. In Meier's opinion "size" is crucial. No class should have more than twenty students and, no school should have more than twenty teachers. No school, consequently, should have more than 400 students. (Meier 1995)

Smallness is a prerequisite for the climate and culture that we need to develop in the habits of heart and mind essential to a democracy. Such a culture emerges from authentic relationships built on face-to-face conversations by people engaged in common work and common work standards. (Meier 1996) Meier believes there are at least seven reasons why small schools containing 300-400 students, work best and offer probably the only chance of carrying out serious reforms in curriculum:

1. Governance. The school faculty should be able to meet around one common table. Studies in group efficiency suggest that once you have more than twenty people in a group you have lost it. Some will be grading papers, others will be working on their lesson plans, and many will not voice their opinion.

2. Respect. Students and teachers in school with thousands cannot know one another well. And if they do not know one another, they cannot respect one another. Parents cannot respect teachers if they do not get a chance to get to know them. Small class size gives teachers the opportunity to get to know all of their students' parents.

3. Simplicity. Most schools have a large and complex bureaucracy, and then they simplify, or standardize, the students. They teach from one-size-fits-all curricula, and treat students as interchangeable parts.

4. Safety. The data are clear that the smaller the school, the fewer the incidents of violence, as well as vandalism and just plain rudeness. There is safety in just being known, especially when you are known by people who care for you.

5. Parent involvement. Schools can often be intimidating places for parents. They feel like outsiders, strangers, and intruders. Schools often give up on parents, especially by the time the students reach high school. Parents are often not contacted at all unless their child has gotten into some kind of trouble. It is not difficult to see why the parents lose patience with the system. In small schools it is easier for the teachers and administrators to contact all parents, not just those whose children are troublemakers. Parents have a more positive attitude toward the school, and this attitude rubs off onto the student.

6.Accountability. How likely is it that a principal of a school with 100 teachers knows how they really teach? Only in small schools can we figure out how to hold a faculty responsible for the work of the school as a whole. Scandals and outrages may be no less likely in a small school, but they are a heck of a lot harder to hide. Padded payrolls, ghost students, or missing equipment will not go unnoticed. Schools that are small can more easily take seriously their public character. In doing so they go a long way toward being accountable.

7. Belonging. In small schools and classes we are more likely to pass on to the students the habits of heart and mind that define an educated person. We can teach them what it is like to be a grown-up, bringing them into our culture. But this will only happen if they find that culture compelling, credible, and accessible. If they cannot join our club and we do not know theirs, we are unlikely to influence each others.

Meier's small school was a success. Now several smaller schools have been developed in place of the few larger schools. The district used every available space to accommodate these new smaller schools. In what was once 20 schools housed in 20 buildings, there are now 52 schools housed in those same 20 buildings. (Meier 1996)

Although Meier's first schools were designed for elementary school students, high schools face the same problems. If one looks closely enough, big high schools are already divided into smaller schools. The kids create them themselves. The problem with this is the fact that only two of the subgroups, each a small minority, have adults as significant people in them. The first are the academic stars. The honors and advanced placement students, student government or debating society participants, or school newspaper staff. The second are the star athletes who belong to various sports teams. The faculties know these kids well; they share common values and aspirations. Occasionally there is a third group for artistic students, but more and more these programs are being cut because of funding problems. This leaves 70-80 percent of the students in other groups where grown-ups are not included. In the past these were the students who eventually dropped out to join the adult world of work. The problem is, there are no longer grown-up occupations for dropouts.

What small schools and small classes are working for is schools that do for all kids what we now do for a few. We want to make that the dominant culture for the school. (Meier 1995)

Despite the success of these schools in New York, and the fact that smaller classes have long been the chief pedagogical tool of private schools, many educational experts have consistently dismissed class size as irrelevant to student performance. It has often been suspect that this position is simply a justification for not spending more on overcrowded urban schools, rather than a fair analysis of the evidence. (Mosle 1996)

Research now exists that provides unambiguous proof that the reduction of class size, especially in the elementary grades, dramatically improves student performance, regardless of the school or the student background. What's more, this research comes from conservative quarters. (Mosle 1996)

From 1985 to 1989, the state of Tennessee, under Governor Lamar Alexander, conducted a statewide study of the effects of smaller classes on student performance. Because of the potential costs of reducing class sizes, members of the Tennessee legislature felt that the proposed innovation should be based on solid information, and a well conducted study. (Mosteller 1996) The Tennessee legislature provided funds to reduce class size in seventy-nine different schools across the state. The study would be primarily concerned with the early years of education(kindergarten through forth grade). Classes were selected randomly, and were divided into three groups: 1) small: 13-17 pupils 2) regular: 22-25 pupils and 3) regular size with a teacher's aide : 22-25 pupils. Besides providing funds for reducing class size, no other assistance was provided. Over the next four years, student performance was regularly assessed not only with standardized tests, but with curriculum-based tests as well. (Mosteller 1996)

The Tennessee study, which became known as project STAR (Student Teacher Achievement Ratio), demonstrated the substantial positive effects of early small class experience on student achievement. (Achilles 1996) Project STAR involved more than 7,000 students. Teachers were assigned at random, and each school with a small class also had at least one class of each other type. This in school design controlled for such building-level effects as leadership, schedule, curriculum, and expenditures. Students were tested in controlled, monitored conditions. (Achilles 1996)

Charles M. Achilles, who was the principal investigator for Project STAR, states that Project STAR data provides a resoundingly affirmative response to the question, "Does class size make a difference in the primary grades?" This research leaves no doubt that small classes have an advantage over larger classes in reading and mathematics. Project STAR continued to maintain the database after the four years of study had concluded. They continued to follow the progress of students to learn of the lasting benefits. The lasting benefits study results show that in 8th grade, students who had small classes in grades K-3 remain significantly ahead of those who were in regular classes.(Achilles 1996) Project Challenge, a policy application of Project STAR findings in 16 of the state's poorer districts, has shown that students have moved from well below to somewhat above the state average performance in 3rd grade reading and math. Several other project-based studies are showing similar results. (Achilles 1996)

In subsidiary studies drawing on Project STAR data, it has been found that, compared to larger classes,

* small classes ameliorate the effects of large schools;
* fewer students are held back a grade;
* while small classes benefit all students, minority students benefit the most;
* students receive more individual attention;
* smaller classes are friendlier and more intimate;
* there are fewer discipline problems in smaller schools;
* students are more likely to participate in activities.

In brief, Project STAR data show that small classes in early primary grades benefit students and provide a basis for substantial education reform without necessarily requiring massive infusions of funds. Consider some of the potential cost saving from using small classes: fewer retentions, less remediation or special education, improved behavior, and increased achievement. Project

STAR and numerous subsequent studies conducted using it's database provide the best research to date on class size effects. (Mosteller 1995)

In summary, the Tennessee class size project was a controlled experiment which is one of the most important educational investigations ever carded out. It illustrated the kind of research needed in the field of education to strengthen schools. This study found that class size appreciably affected student performance, boosting reading and math scores over time, and also that these effects held well into junior high, even after students were returned to regular-size classes. Students in the smallest classes, in every kind of school, did better than their counterparts in regular classes. The main finding was that a small class size in the earliest grades speeds learning in these years and confers lasting benefits into later grades to students with this start. (Mosteller 1996) As a result of Project STAR, eleven states have agreed to enact class-size initiatives.(Achilles 1996)

With all of this evidence one would think that the class size issue has been resolved. Unfortunately, that is not the case, the issue is just beginning to receive the attention it deserves. The biggest problem facing the class size issue is money. Reducing class size is an expensive endeavor and, despite claims of enthusiasts, the benefits of this strategy are, at best, uncertain.

Just how much would the cost of education increase if class sizes were decreased ? In Georgia House speaker Tom Murphy planned a campaign to reduce the teacher-pupil ratio to 1-15 in the first five grades. The state's director of general instruction called Murphy's plan "great news" even though he acknowledged that the state would face big teacher shortages and would have to step up it's already intensive recruitment campaign. At the same time the state's legislative budget office estimated that it would cost between $200 million and $300 million annually to reduce the ratio in all five grades. (Tomlinson 1988)

Just last year California made an ambitious attempt to improve the dismal academic record of it's elementary schools. The Governor, Pete Wilson, announced that he planned to spend $971 million dollars on reducing class size for 5-8 year olds. Each class with 20 or fewer children will get a grant of $19,500. Schools had until February of 1997 to hit the target, but most shifted into high gear right away. (The Economist 1996)

Pete Wilson hit on the idea of cutting class-size in July of 1996, When he discovered that he had nearly $1 billion more to spend on education than he had expected. Since 1988 California's constitution has required that a certain portion of the budget must be spent on education. This means that as the state emerges from recession, the schools get showered with gold. (The Economist 1996)

The state of New Jersey, which puts out a list of demonstrably effective programs each school year, has reducing class size as one of it's programs. Project code 112 states " While there is some controversy about the effectiveness of reducing class size, there is little doubt that smaller classes provide an opportunity for using a greater variety of instructional techniques, giving more attention to individual students, and providing more individualization of instruction. Put another way, simply decreasing class size by itself will not improve student learning if teachers continue to use the same instructional methods and procedures in the smaller classes that they used in the larger classes. The more promising effects of improved instruction resulting from class size reductions typically occur in the primary grades, particularly in grades K-3"

Initiatives, such as the one in Georgia, and the one in California, are creating even more controversy. The costs are enormous, and the results are still controversial. Couldn't the same or better results be achieved far more economically by improving instructional practice, instructional technology, the quality of textbooks or the training of teachers ? Isn't class size only one part in improving learning ? Shouldn't good teaching, parent involvement and a strong curriculum be considered too ? Many would argue that those things go hand in hand with reducing class size. As was the case with the small school initiative designed by Deborah Meier, small schools , and small classes promote better teacher-parent communication, better curricula, and better teaching techniques.

Sara Mosle, in an article in The New Republic, November 11, 1996, says that the President should make reducing class sizes, particularly in poorer and overcrowded schools, a top goal. She sites Project STAR as proof that smaller classes during the elementary years produced dramatic boosts in achievement regardless of student background. She also sites the results which show that the benefits of this reduced class size in the elementary years held even into the later years when students were returned to larger classes. The President wants all children to read by the time they are in the third grade, Mosle believes the only way to achieve that goal is by reducing class size. Instead of giving money to states for special education or other "pull-out" programs, the federal government should give funds to schools exclusively to reduce class size; if every class, particularly in the earliest grades, had 20 students or less, Then every child would receive a "Special education". (Mosle 1996)

CHAPTER III
DESIGN OF THE STUDY

Rational :

It has long been the view of the teacher that smaller classes promote better academic achievement on the part of the student. Although many studies have been done, and many high ranking political personalities have endorsed the idea, it still ranks among the highest controversies in the educational field. The studies are inconclusive, and the implementation of smaller classes would be an expensive undertaking. This study was designed to see if class size would create a difference in academic achievement among high school biology students.

Hypothesis:

After reviewing the literature, it would seem that class size does have an impact on a students ability to achieve. Although most studies suggest that class size is of most importance during the early years of a child's education, All students should be able to benefit from the more conducive atmosphere of a small class. Therefore the hypothesis would be that students in smaller classes will have a greater increase in academic achievement.

Methods and Materials:

Initial data was gathered by comparing final biology averages from classes with as few as nine students, with classes with as many as twenty five students. HSPT scores were gathered on each of the students in those classes to see if the intelligence level was a factor. The current study involved two advanced biology classes that are currently being taught. One class has twenty students, and the other has twenty five. The general biology could not be used in this study because there are thirty students in both classes. Each of the two advanced biology classes were given a pre-test on the subject of invertebrates. The classes were then engaged in a four week study of invertebrates which included such traditional teaching methods as lecture, laboratory investigations, group work, and research. After the four weeks of study a post-test was given. A statistical analysis will be done to decide if there was any significant difference between the two classes.

Pre-Test:

The pre-test consists of 14 short answer questions, and 9 matching questions. Their knowledge of the classification of organisms into the sub-kingdom invertebrate will be tested.

Post-Test:

The post test will be identical to the pre test. This test will be used to measure the knowledge gained during the four weeks of instruction. A comparison of the pre and post test scores will be done using a statistical analysis program. The program that will be used is the Microsoft Excel program.

Limitations of the study

The high school at which this study was done has an enrollment of 548 students. The percentage of seniors attending a 2 or 4 year college is 35%.

The socioeconomic backgrounds of the high school is middle class. The sample population for this experimental study was taken from students enrolled in two sections of Advanced Biology. The racial make-up of the school is 48% African American, 47% Caucasian, 5% Hispanic, .1% Native American and .1% Asian American. There were 20 students enrolled in the smaller biology class, and 25 enrolled in the larger class. The study could not be conducted with the general level biology classes, as they both had enrollments over 30. Information sources for this project were limited to those available through the Library of Rowan University.

CHAPTER IV
ANALYSIS OF THE DATA

Introduction

In order to determine the effect of smaller classes on academic achievement in a biology class, data on learning was collected during the study. This chapter explains how the data was analyzed, what tables were made to show the results, what the results were, and what those results indicate.

Results

Before beginning the actual experiment, data was collected from previous biology classes. End of the year averages were compared between classes ranging in size from 9 students to 23 students. Because it was impossible to use the standard pre and post test experiment on these past students, HSPT averages were used to determine intelligence levels. Table 4a shows the results from 7 Advanced Biology classes taught over the last three years. Although all classes had higher class averages than HSPT averages, There was no significant difference between the smaller classes and the larger classes. (see t-test results in table 4a) Table 4b shows the same figures for general biology classes. These classes also had higher class averages than HSPT averages. Although statistically there was not a significant difference between the two, (see t-test results in table 4b) There was a pattern showing that as class size increased performance decreased.

The data collected from the experimental groups can be found in table 3a, and 3b. Table 3a shows the pre and post-test scores for the larger biology class which had 25 students. The pre-test mean for this group was 32.52, and the post-test mean was 91.92. This shows an increase in the mean of 59.4. Table 3b shows the pre and post-test scores for the smaller biology class which had 20 students. The pre-test mean for this class was 24.1, and the post-test mean was 80.25. This shows an increase in the mean of 56.15. Table 5 shows the results of a two sample t-test on these figures. This test is designed to test the equality of the means of two populations based on independent samples when neither population standard deviation is known. The calculated t value of .74389 fell within the critical t interval of -5.701 and 12.201. These results show that there is no significant difference between the two populations. Therefore, the hypothesis that smaller classes will have greater academic achievement, was not proven true.

Table #3a - !997/98 Advanced Biology Pre-Test and Post-test Scores

Class #1 - 25 students

STUDENT	PRE-TEST	POST-TEST	INCREASE
Student #1	30%	93%	63%
Student #2	56%	100%	44%
Student #3	30%	98%	68%
Student #4	35%	96%	61%
Student #5	30%	96%	66%
Student #6	43%	100%	57%
Student #7	39%	100%	61%
Student #8	30%	86%	56%
Student #9	35%	88%	53%
Student #10	30%	98%	68%
Student #11	22%	84%	62%
Student #12	30%	97%	67%
Student #13	22%	70%	48%
Student #14	48%	79%	31%
Student #15	26%	77%	51%
Student #16	35%	95%	60%
Student #17	26%	82%	56%
Student #18	43%	97%	54%
Student #19	30%	100%	70%
Student #20	30%	98%	68%
Student #21	26%	95%	69%
Student #22	26%	94%	68%
Student #23	39%	100%	61%
Student #24	39%	90%	51%
Student #25	13%	85%	72%
Mean	32.52	91.92	59.4

Table 3b - 1997/98 Advanced Biology Pre-test and Post-test scores

Class #2 - 20 students

STUDENT	PRE-TEST	POST-TEST	INCREASE
Student #1	9%	80%	71%
Student #2	13%	58%	45%
Student #3	39%	88%	49%
Student #4	22%	100%	78%
Student #5	52%	72%	20%
Student #6	35%	89%	54%
Student #7	48%	90%	42%
Student #8	30%	98%	68%
Student #9	4%	92%	88%
Student #10	30%	91%	61%
Student #11	26%	60%	34%
Student #12	30%	64%	34%
Student #13	17%	71%	54%
Student #14	26%	86%	60%
Student #15	17%	62%	45%
Student #16	13%	63%	50%
Student #17	17%	92%	75%
Student #18	22%	68%	46%
Student #19	9%	84%	75%
Student #20	23%	97%	74%
Mean	24.1	80.25	56.15

Table #4a - Comparing Class Averages and HSPT Averages

Advanced Biology Classes

CLASS SIZE	CLASS AVERAGE	HSPT AVERAGE	DIFFERENCE
10	79.6%	72.7%	+6.9%
13	70.85%	68.6%	+2.25%
15	82.73%	77%	+5.73%
17	76.94%	67%	+9.94%
18	83%	77%	+6%
20	83.3%	73%	+10.3%
23	86.26%	82.1%	+4.16%

Class size under 20 - mean difference = 6.164

Class size 20 and over - mean difference = 7.23

t value = .40076

t critical = -6.313, 6.313

Table #4b - Comparing Class Averages and HSPT Averages

General Biology

CLASS SIZE	CLASS AVERAGES	HSPT AVERAGES	DIFFERENCE
9	82.78%	61.1%	+21.68%
18	81.05%	58%	+23.05%
22	80.86%	63%	+17.86%
23	75%	64%	+11%

Class size under 20 - mean difference = 22.3

Class size 20 and over - mean difference = 14.43

t value = .0756

t critical = -4.302, 4.302

Table 5: TWO SAMPLE t TEST RESULTS

	Variable 1	Variable 2
Mean	59.4	56.15
Variance	.009175	.030834
Observations	25	20
df	28	
t Stat	.743895	
T interval	-5.701, 12.201	
Standard deviation	9.5786	17.5597

CHAPTER V
SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary of findings

In order to determine if class size had any significant effect on the academic achievement of high school biology students, a unit on invertebrates was taught to two sample groups. The first group was an Advanced Biology Class consisting of 25 students. The second was also an Advanced Biology Class , however this class had 20 students. Both groups were given a pre test on the subject to determine current ability levels. At the conclusion of the unit the classes were given post-tests which were identical to the pre-test. The mean values of the pre and post-tests were compared, and an independent t-test was done to determine if the differences were significant. Using both one-tailed and Two-tailed t-tests, results showed that the t values fell within the critical ranges. Therefore there is no significant difference in the academic achievement between the two classes.

Conclusions

Based on the findings of this study, there is no significant difference in the academic achievement of students in class sizes of 20 Vs 25.

Recommendations

Based on the findings of this study, it would seem that there is no significant difference between the academic achievement of students in small biology classes and those in larger biology classes. However, the literature review would indicate that there is a significant difference, at least in the early grades. More research should be done at a time when class size has a greater range, and when general level classes could also be included.

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APPENDIX

Table #1a - Advanced Biology Class Averages and HSPT Scores

Class size - 10 students

STUDENT	CLASS AVERAGE	HSPT SCORE
Student #1	86	R - 337 M - 381 W - 383
Student #2	77	R - 281 M - 378 W - 354
Student #3	74	?
Student #4	79	R - 353 M - 363 W - 387
Student #5	91	R - 390 M - 449 W - 371
Student #6	89	R - 417 M - 387 W - 362
Student #7	56	R - 337 M - 348 W - 361
Student #8	83	R - 337 M - 239 W - 286
Student # 9	78	R - 379 M - 442 W - 347
Student #10	83	R - 406 M - 428 W - 313

Class Average - 79.60 % HSPT Average Reading "R" - 360
Math "M" - 378
Writing "W" - 352
1090/1500=72.7%

? - Student files not available

Table #1b - Advanced Biology Class Averages and HSPT Scores

Class size - 23 students

STUDENT	CLASS AVERAGE	HSPT SCORE
Student #1	98	R - 468 M - 500 W - 495
Student #2	79	?
Student #3	84	R - 423 M - 477 W - 376
Student #4	88	?
Student #5	73	R - 348 M - 383 W - 341
Student #6	92	R - 384 M - 470 W - 390
Student #7	79	R - 328 M - 385 W - 362
Student #8	94	R - 445 M - 491 W - 415
Student #9	75	R - 353 M - 449 W - 381
Student #10	96	R - 451 M - 470 W - 445
Student #11	85	R - 384 M - 375 W - 367
Student #12	90	R - 374 M - 404 W - 396
Student #13	76	R - 348 M - 389 W - 361
Student #14	91	R - 457 M - 460 W - 376

Table #1b continued

STUDENT	CLASS AVERAGE	HSPT SCORE
Student # 15	91	R - 412 M - 446 W - 386
Student #16	96	R - 457 M - 491 W - 445
Student #17	95	R - 479 M - 474 W - 440
Student #18	89	R - 463 M - 414 W - 417
Student #19	58	R - 337 M - 400 W - 297
Student #20	89	?
Student #21	96	R - 479 M - 491 W - 440
Student #22	82	R - 364 M - 414 W - 358
Student #23	88	R - 457 M - 457 W - 455

Class Average - 86.26% HSPT Average - Reading "R" - 411
Math "M" - 442
Writing "W" - 379
1232/1500=82.1%

? - Student files not available

Table # 1c - Advanced Biology Class Averages and HSPT Scores

Class size - 17 students

STUDENT	CLASS AVERAGE	HSPT SCORE
Student #1	81	R - 343 M - 371 W - 358
Student #2	84	R - 299 M - 396 W - 295
Student #3	87	R - 374 M - 428 W - 379
Student #4	61	R - 374 M - 375 W - 333
Student #5	80	R - 401 M - 396 W - 362
Student #6	86	R - 368 M - 453 W - 362
Student #7	72	R - 294 M - 352 W - 290
Student #8	80	R - 353 M - 286 W - 345
Student #9	75	R - 262 M - 303 W - 354
Student #10	72	R - 332 M - 371 W - 341
Student #11	85	R - 379 M - 355 W - 408
Student #12	83	R - 299 M - 359 W - 327
Student #13	83	R - 343 M - 210 W - 362

Table #1c continued

STUDENT	CLASS AVERAGE	HSPT SCORE
Student # 14	74	R - 258 M - 282 W - 269
Student #15	64	R - 323 M - 277 W - 300
Student #16	70	R - 258 M - 348 W - 295
Student #17	71	R - 309 M - 248 W - 336

Class Average - 76.94% HSPT Average - Reading "R" - 327
Math "M" - 342
Writing "W" - 336
1005/1500=67%

Table #1d - Advanced Biology Class Averages and HSPT Scores

Class size - 13 students

STUDENTS	CLASS AVERAGE	HSPT SCORE
Student #1	80	R - 423 M - 324 W - 406
Student #2	67	R - 245 M - 352 W - 286
Student #3	77	R - 379 M - 411 W - 347
Student #4	71	R - 267 M - 261 W - 277
Student #5	66	R - 353 M - 411 W - 317
Student #6	78	R - 328 M - 298 W - 261
Student #7	55	R - 409 M - 327 W - 371
Student #8	78	R - 457 M - 294 W - 342
Student #9	87	R - 353 M - 396 W - 371
Student #10	75	R - 395 M - 393 W - 333
Student #11	60	R - 368 M - 371 W - 338
Student #12	70	R - 258 M - 274 W - 294

Table # 1d continued

STUDENT	CLASS AVERAGE	HSPT SCORE
Student #13	57	R - 368 M - 408 W - 304

Class Average - 70.85 %   HSPT Average -   Reading "R" - 354
Math "M" - 348
Writing "W" - 327
1029/1500=68.6%

Table # 1e - Advanced Biology Class Averages and HSPT Scores

Class size - 15

STUDENT	CLASS AVERAGE	HSPT SCORE
Student #1	83	R - 425 M - 481 W - 415
Student #2	77	R - 401 M - 481 W - 390
Student #3	90	R - 366 M - 358 W - 371
Student #4	95	R - 413 M - 424 W - 406
Student #5	78	R - 389 M - 317 W - 358
Student #6	83	R - 338 M - 456 W - 404
Student #7	88	R - 466 M - 465 W - 381
Student #8	82	R - 413 M - 468 W - 362
Student #9	90	R - 355 M - 447 W - 354
Student #10	75	R - 384 M - 432 W - 320
Student #11	84	R - 355 M - 409 W - 381
Student #12	72	R - 282 M - 299 W - 329
Student #13	77	R - 307 M - 447 W - 350

Table 1e continued

STUDENT	CLASS AVERAGE	HSPT SCORE
Student #14	87	R - 366 M - 414 W - 300
Student #15	80	R - 355 M - 369 W - 362

Class Average - 82.73%   HSPT Average - Reading "R" - 374
Math "M" - 415
Writing "W" - 366
1155/1500 = 77%

Table #1f - Advanced Biology Class Averages and HSPT Scores

Class size - 20

STUDENT	CLASS AVERAGE	HSPT SCORE
Student #1	89	R - 338 M - 453 W - 371
Student #2	93	R - 361 M - 394 W - 358
Student #3	83	R - 407 M - 441 W - 347
Student #4	94	R - 466 M - 491 W - 401
Student #5	72	R - 372 M - 344 W - 354
Student #6	75	R - 272 M - 328 W - 331
Student #7	93	R - 436 M - 418 W - 396
Student #8	88	R - 322 M - 286 W - 396
Student #9	93	R - 430 M - 462 W - 390
Student #10	86	R - 332 M - 365 W - 275
Student #11	83	R - 277 M - 317 W - 329
Student #12	90	R - 383 M - 462 W - 367
Student #13	72	R - 328 M - 340 W - 282

Table #1f continued

STUDENT	CLASS AVERAGE	HSPT SCORE
Student #14	76	R - 436 M - 471 W - 376
Student #15	85	R - 322 M - 459 W - 331
Student #16	84	R - 361 M - 414 W - 376
Student #17	83	R - 302 M - 336 W - 345
Student #18	70	R - 401 M - 249 W - 329
Student #19	73	R - 344 M - 381 W - 374
Student #20	84	R - 322 M - 328 W - 300

Class Average - 83.3%   HSPT Average   Reading "R" - 361
Math "M" - 387
Writing "W" - 351
1099/1500 = 73%

Table #1g - Advanced Biology Class Averages and HSPT Scores

Class size - 18

STUDENT	CLASS AVERAGE	HSPT SCORE
Student #1	85	R - 454 M - 394 W - 350
Student #2	75	R - 378 M - 429 W - 358
Student #3	75	R - 292 M - 403 W - 395
Student #4	76	R - 383 M - 441 W - 345
Student #5	94	R - 372 M - 462 W - 354
Student #6	81	R - 383 M - 362 W - 362
Student #7	86	R - 442 M - 412 W - 415
Student #8	91	R - 361 M - 426 W - 376
Student #9	85	R - 448 M - 465 W - 379
Student #10	87	R - 407 M - 435 W - 412
Student #11	90	R - 361 M - 362 W - 347
Student #12	76	R - 418 M - 403 W - 430
Student #13	83	R - 471 M - 412 W - 313

Table #1g continued

STUDENT	CLASS AVERAGE	HSPT SCORE
Student #14	77	R - 313 M - 412 W - 300
Student #15	75	R - 332 M - 406 W - 292
Student #16	87	R - 262 M - 358 W - 313
Student #17	94	R - 430 M - 468 W - 347
Student #18	78	R - 395 M - 358 W - 383

Class Average - 83 %   HSPT Average - Reading "R" - 383
Math "M" - 412
Writing "W" - 360
1155/1500 = 77 %

Table #2a - General Biology Class Averages and HSPT Scores

class size - 9 students

STUDENT	CLASS AVERAGE	HSPT SCORE
Student #1	89	?
Student #2	83	R - 214 M - 331 W - 293
Student #3	89	R - 383 M - 387 W - 343
Student #4	83	R - 235 M - 255 W - 313
Student #5	80	Drop out
Student #6	72	R - 320 M - 335 W - 345
Student #7	80	?
Student #8	89	R - 283 M - 288 W - 331
Student #9	80	R - 264 M - 225 W - 354

Class Average - 82.78% HSPT Average - Reading "R" - 283
Math "M" - 304
<u>Writing "W" - 330</u>
917/1500=61.1%

? - Student files not available

Table #2b - General Biology Class Averages and HSPT Scores

Class size - 18 students

STUDENT	CLASS AVERAGE	HSPT SCORE
Student #1	81	R - 228 M - 248 W - 338
Student #2	80	R - 314 M - 191 W - 271
Student #3	76	R - 295 M - 297 W - 293
Student #4	79	R - 248 M - 237 W - 267
Student #5	82	R - 231 M - 276 W - 314
Student #6	84	R - 301 M - 191 W - 343
Student #7	83	R - ex M - ex W - 298
Student #8	80	R - 353 M - 255 W - 329
Student #9	85	R - 320 M - 304 W - 288
Student #10	78	R - 353 M - 321 W - 324
Student #11	76	R - 358 M - 208 W - 298
Student #12	78	R - 228 M - 246 W - 258
Student #13	70	?

Table 2b continued

STUDENT	CLASS AVERAGE	HSPT SCORE
Student #14	86	R - 315 M - 292 W - 403
Student #15	92	R - 297 M - 448 W - 372
Student #16	71	Drop out
Student #17	85	R - 343 M - 339 W - 309
Student #18	93	R - 231 M - 225 W - 254

Class Average - 81.05%   HSPT Average - Reading "R" - 294
Math "M" - 272
Writing "W" - 310
876/1500=58%

? - Student files not available
ex - Special ed exemption

Table #2c- General Biology Class Averages and HSPT Scores

class size - 23 students

STUDENT	CLASS AVERAGE	HSPT SCORE
Student #1	59	R - 199 M - 140 W - 215
Student #2	91	R - 378 M - 429 W - 358
Student #3	73	R - 389 M - 352 W - 336
Student #4	76	R - 213 M - 328 W - 269
Student #5	88	R - 374 M - 375 W - 333
Student #6	91	R - 407 M - 400 W - 358
Student #7	87	R - 395 M - 340 W - 376
Student #8	79	R - 366 M - 312 W - 308
Student #9	86	R - 348 M - 348 W - 294
Student #10	82	R - 230 M - 183 W - 252
Student #11	77	EX
Student #12	79	R - 328 M - 340 W - 282
Student #13	93	R - 332 M - 362 W - 302

Table 2c continued

STUDENT	CLASS AVERAGE	HSPT SCORE
Student #14	72	R - 267 M - 299 W - 316
Student #15	76	R - 287 M - 325 W - 308
Student #16	79	R - 383 M - 381 W - 329
Student #17	90	R - 368 M - 408 W - 304
Student #18	80	R - 292 M - 221 W - 273
Student #19	83	R - 277 M - 295 W - 265
Student #20	18	Drop out
Student #21	42	Drop out
Student #22	70	R - 355 M - 340 W - 319
Student #23	70	R - 350 M - 286 W - 327
Student #24	59	R - 344 M - 355 W - 350

Class Average - 75 %   HSPT Average - Reading "R" - 328
Math "M" - 325
Writing "W" - 307
960/1500 = 64 %

Ex = Special Ed Exemption

Table #2d - General Biology Class Averages and HSPT Scores

Class size - 22 students

STUDENT	CLASS AVERAGE	HSPT SCORE
Student #1	88	R - 322 M - 358 W - 341
Student #2	71	R - 145 M - 144 W - 194
Student #3	86	R - 332 M - 299 W - 320
Student #4	94	R - 407 M - 400 W - 331
Student #5	76	?
Student #6	73	Ex
Student #7	81	R - 287 M - 268 W - 286
Student #8	80	R - 383 M - 369 W - 304
Student #9	91	R - 353 M - 411 W - 317
Student #10	91	R - 332 M - 340 W - 345
Student #11	82	R - 302 M - 312 W - 311
Student #12	61	Ex
Student #13	89	R - 355 M - 424 W - 313

Table 2d continued

STUDENT	CLASS AVERAGE	HSPT SCORE
Student #14	70	R - 317 M - 175 W - 232
Student #15	82	R - 258 M - 277 W - 277
Student #16	85	R - 328 M - 344 W - 323
Student #17	80	R - 383 M - 344 W - 362
Student #18	88	R - 317 M - 409 W - 300
Student #19	96	R - 267 M - 372 W - 358
Student #20	84	R - 292 M - 245 W - 298
Student #21	51	R - 361 M - 378 W - 317
Student #22	80	R - 258 M - 245 W - 282

Class Average - 80.86 %   HSPT Average - Reading "R" - 316
Math "M" - 322
Writing "W" - 306
944/1500 = 63%

? = Student files unavailable
Ex = Special Ed exemption

Pre test on Invertebrates

Name________________________

1. Invertebrates are animals that lack what ?

2. How many phyla of invertebrates are there ?

3. What do the following words mean?

   Porifera -

   Cnidarian -

   Mollusk -

   Echinoderm -

   Arthropod -

4. What are the three groups of worms ?

   A -

   B -

   C -

5. Define the following words.

   Molting -

   Metamorphosis -

   hermaphrodite -

   Dioeceous -

6. Match the following organisms with their proper group

A. Sponge	Cephalapod _______
B. Jellyfish	Crustacean ________
C. Starfish	Porifera ________
D. Spider	Segmented worm ________
E. Squid	Flatworm ________
F. Earthworm	Echinoderm ________
G. Clam	Mollusk________
H. Tapeworm	Arthropod ________
I. Crab	Cnidarian ________