Analysis of MCAS Performance with Respect to Student Mobility and other Demographic Factors

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by

Conway Chuong

Ezra Moses

Sumeet Chani

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Approved:

Professor James Doyle, Project Advisor

Professor Jeanine D. Plummer, Co-Advisor

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Authorship

The Analysis of MCAS Scores with Respect to Student Mobility and Other Demographic Factors represents combined efforts from Ezra Moses, Sumeet Chani, and Conway Chuong. Throughout the early days of our project, equal time was spent on attaining and cleaning up the data. This consisted of all the group members cross-referencing the students to a database to ensure accuracy when doing our initial analysis.

When this was complete, the focus of our goals turned toward data analysis and revision of our proposal. Conway used our data that we had collected and analyzed it using the statistical software package SPSS, performing the required statistical analyses. Afterwards he documented his findings in the Results and Analysis section. Sumeet and Ezra began to revise and update the proposal, as well as aiding in the efficiency of Conway's analysis.

As the term neared completion, we decided that we could be more efficient by splitting up the remaining sections of the proposal and focusing on these sections individually, and then tying everything together afterwards. Sumeet spent her time revising and updating the introduction sections as well as the background. Ezra completely revised the methodology section. Because of the many changes our project undertook, the methodology section was constantly being changed. Conway concluded his analysis by writing and editing the Results and Analysis section, and editing the Methodology section as necessary. He then finalized the paper with any grammatical or organizational issues.

Abstract

The Massachusetts Comprehensive Assessment System (MCAS) is a result of the Massachusetts Education Reform Law of 1993. The law required a three-stage reform process: the Common Core of Learning, which was a set of goals delegated by Massachusetts citizens for public school students; the Curriculum Frameworks, a specific curriculum for each grade level and subject, based on the demands of the Common Core; and the MCAS test, which was designed to assess each student's fulfillment of the standards set in the Frameworks.

Since its implementation, the MCAS has been the harbinger of controversy amongst politicians, teachers, parents, and students. The test's difficulty level has been assessed through various groups and organizations with much debate. Now being used as a school review tool, the MCAS threatens to alter public school curriculum, some seeing it as positive educational reform while others viewing it as degradation of education. Furthermore, the MCAS now serves as a graduation requirement, sparking tremendous debate as well.

Among these controversial issues of validity regarding the MCAS test, the main area of concern that we studied is that of student mobility. We analyzed the graduating classes of 2002 and 2003, who were administered the MCAS in 8th and 10th grades. It was found that about 50% of students in the 8th grade leave the school system after this year, while about one-third of students in 10th grade were not originally present in the 8th grade. We determined the performance levels of mobile students—that is, students who were present for only one of the two tests—and compared them to the performance of non-mobile students—that is, students who were present for both tests. We found that

mobile students tended to score several points lower than non-mobile students in both graduating classes.

Furthermore, we performed a linear regression analysis, which would attempt to predict 10^{th} grade test scores based on 8^{th} grade scores, to imitate zero mobility. We found that students in the class of 2002 tended to decrease in test scores from 8^{th} to 10^{th} grade. Results for the class of 2003 were inconclusive, however, and a prediction could not be formed.

Afterwards we studied test scores based on ethnicity, and found that White and Asian students consistently tended to score higher on both sections of the test than Black and Hispanic students. Gender was also studied, to determine how males and females compared with each other on the test. It was found that females tended to score only a few points higher than males on the English Language Arts portion of the test, while the two genders scored similarly in the Mathematics section. Free and reduced lunch was used to determine the presence of low-income students, to study for further trends. It was found that these low-income students scored about 10 points lower than the remaining students.

Our analysis will hopefully benefit the Worcester Public Schools, in helping assess reasons for student performance on the MCAS test.

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1. Introduction

For decades, there has been growing concern over the state of the nation's education system. As a result, much has been done in the way of improvement; Massachusetts, in particular, has risen to this challenge. In 1993, the Massachusetts Legislature passed an education reform law. One key element in this law was the additional requirement that students must pass a rigorous standardized test in order to receive a high school diploma. This test is known as the Massachusetts Comprehensive Assessment System, or MCAS.

The purpose of the MCAS is to measure individual student performance as well as the proficiency of schools and districts based on the standards set by the state Curriculum Frameworks. The Massachusetts Department of Education (DOE) also intends for the MCAS to improve classroom instruction while increasing student achievement. All students educated by Massachusetts's public funds must take the MCAS test in order to graduate, including students with disabilities and those enrolled in special education programs. As a result, the MCAS has been the topic of ample debate.

The implementation of the MCAS has been followed by a great deal of controversy. Many concerns arose when, after the majority of the initially tested students failed, it was stated that this test must be passed in order to receive a high school diploma, beginning with the class of 2003. Despite these concerns, voiced by the Massachusetts Teachers Association and parents alike, the Massachusetts DOE decided to implement the test. Furthermore, the DOE has also stated schools and principals will be directly accountable for MCAS scores. With these factors dependent on MCAS results, it is clearly important that the process of assessment take into consideration the many factors that may affect test scores.

Currently, the Massachusetts DOE compares the mean test scores produced by the same grade over 3 years. For example, the ‘98-‘99 8th grade mean MCAS score was be compared to the ’99-’00 8th grade mean MCAS score, and the same will occur for the following ’00-’01 8th grade mean score. The DOE requires that each school improve by a certain number of points per tested year. If the school does not show improvement, the DOE provides that school with special attention and funding for support programs. The Massachusetts DOE does not take student mobility into consideration when assessing mean scores for each school. In Worcester, with its wide variety of available educational options, mobility could have a great effect on 10th grade mean scores. Our team will analyze longitudinal data from the Worcester Public Schools (WPS) and determine what effect, if any, student mobility has on mean test scores.

Our goal is to determine the effects of mobility, from 8th to 10th grade, on MCAS results. Our hypothesis is: As students progress from 8th grade to 10th grade mobility will affect the MCAS averages per school. A mobile student, in our study, will be defined as any student who is present for only one of the two MCAS tests administered in 8th and 10th grade. A student who participates in the 8th grade MCAS at a middle school within the WPS but is not present for the 10th grade MCAS at a high school within the WPS. Students who participate in the 10th grade MCAS but not the 8th grade MCAS are also considered mobile, as they have entered the WPS after the 8th grade. Students may leave the Worcester Public School system for a variety of reasons, and we hope to identify some of these reasons by surveying high school and middle schools principals.

Student mobility in WPS is a major issue and factor with respect to MCAS scores. As the Superintendent of WPS Dr. James Caradonio mentions, elementary and middle schools such as Elm Park Community School and Chandler Elementary have above 50% mobility rates, meaning that half of the students who begin a school year will leave before its end (McFarlane, 2001a). Dr. Caradonio is concerned that students "who have been with us for a matter of months, those we have not had the opportunity to teach" will not perform as well as those who have been less mobile and educated under the new curriculum (McFarlane, 2001a). He believes that the state should discount the scores of students who are highly mobile when assessing school and district performance (McFarlane, 2001a). His argument recognizes that the state of Massachusetts does not include student mobility when reviewing school performance. Our team hopes to provide useful information to the WPS and in particular the WPS School Committee, who in turn may be able to affectively change the state's policy on school and district assessment if necessary.

Our report unfolds in the following way: first we intend to analyze the background of the MCAS, discussing its history, and controversial issues including test difficulty, test usage as a school review tool, and the MCAS graduation requirement. We will then discuss our methods used to perform our analyses. Lastly, the results of our study will are detailed in our results and analysis sections, and conclusions are given.

2. Background

The Massachusetts Education Reform Act of 1993 called for dramatic changes in public education over a 7-year period. Among the major improvements were greater and more equitable funding for schools, accountability for student learning, and statewide standards for students, educators, schools and districts. Since 1993, the Commonwealth has supported school improvement by providing more than one billion dollars in state aid for education. By the end of this decade, more than two billion new state Education Reform dollars will have been provided to Massachusetts's public schools. This standardized testing movement has developed a great deal of controversy and interest.

Massachusetts is not the only state to implement standardized testing. The Stanford Achievement Test Revision 9 (SAT-9) was implemented in California in compliance with the Standardized Testing and Reporting program (STAR). The SAT-9 is a multiple-choice test, assessing students in Reading, Writing, Mathematics, History-Social Science, and Science. The SAT-9 is administered in cities across the nation, including Worcester, and the large numbers of students in the nation set the expected norm. Another standardized test administered only to Massachusetts was the MCAS test.

2.1 History of the MCAS

In June of 1992, the Massachusetts State legislature passed a bill proposing higher academic standards. This bill became the Education Reform Law of 1993. The law, implemented by the Massachusetts Board of Education (BOE), resulted in dramatic changes in public education over the next 7 years. The law established statewide educational standards for every student. The law's main thrust was a three-step process:

1) *Massachusetts Common Core of Learning*, 2) *Massachusetts Curriculum Frameworks*, and 3) *Massachusetts Comprehensive Assessment System (MCAS)* (DOE, 2001).

The Common Core of Learning, the first step in the reform process, established a set of goals for both students and educators. "We believe it is essential," the DOE stated, "that all students be held to high standards of achievement in reading, writing, speaking standard English, mathematics and science, history and the arts. Failure to do so denies students the opportunity to participate fully in our society and economy" (DOE, 2001a, par. 7). Specifically, the Common Core emphasizes that each student should have skills of "Thinking and Communicating," "Gaining and Applying Knowledge," and "Working and Contributing" (DOE, 2001b, Table of Contents). Thinking and communicating include effective reading skills and writing for understanding and enjoyment, the use of mathematical skills to solve problems, and exploring the arts to express ideas and feelings. To gain and apply knowledge the student should develop skills including scientific inquiry and experimentation skills, relating literary works to human life experiences, and synthesizing and communicating information regarding important historical events. Lastly, skills of working and contributing include developing work effort and integrity, and values of personal responsibility and respect (DOE, 2001).

The BOE established the Commission on the Common Core of Learning, a 40-member commission representing the state and responsible for drafting these goals. From September 1993 to June 1994, the Commission heard comments from approximately 50,000 Massachusetts residents via written communications and public hearings. As a result, subsequent drafts of the "Common Core" document underwent major changes and improvements. The Commission adopted a final draft in June of 1994

(DOE, 2001b, par. 2). The document described general skills that students should attain as defined through the Curriculum Frameworks.

The second step of the Educational Reform process was the development of the Curriculum Frameworks. The Curriculum Frameworks are "of high quality, results driven, and focus on world class standards" derived from the goals named in the Common Core (DOE, 2001c). The Frameworks address standards for the academic areas of Arts, English Language Arts, Foreign Languages, Comprehensive Health, Mathematics, History & Social Science, and Science & Technology/Engineering (DOE, 2001).

Each Curriculum Framework describes standards that students must follow. For each subject area listed above, the Framework establishes learning standards for each educational level, including the achievement of specific goals and topics. Ninth and tenth grade students, for example, are expected to have an understanding of imagery and symbolism in the English Language Arts area, as well as understanding polynomials and the quadratic equation in the Mathematics area (DOE, 2001). David Driscoll, the Commissioner of Education, is confident of the Framework's intentions, stating: "Based on scholarship, sound research, and effective practice, the framework will enable teachers and administrators to strengthen curriculum and instruction from pre-kindergarten through grade 12" (DOE, 2001d, p.1).

All Curriculum Frameworks are continuously refined and subject to continual change and improvement. As academic needs are subject to changes, the Frameworks are designed to accommodate them. "Each of the Curriculum Frameworks will always be considered as works in progress," as the DOE website states, "and we will continue to refine them to strengthen them and to keep them current" (DOE, 2001c, par 3).

The Curriculum Frameworks set the stage for the third and final step of the reform process, the Massachusetts Comprehensive Assessment System (MCAS). The MCAS attempts to measure the criteria named in the Common Core and specified in the Curriculum Frameworks.

2.2 MCAS Test Description

The MCAS tests the academic areas of Mathematics, English Language Arts, History, and Science & Technology/Engineering through multiple-choice, short-answer and open-response type questions. Students are graded on an 80-point scale (200-280) and the scale is broken down into the following performance level categories: Failing (200-219), Needs Improvement (220-239), Proficient (240-259) and Advanced (260-280). More detail on performance levels is available in Appendix B.

The 10^{th} grade MCAS is broken up into 3 major sections: English Language Arts, Mathematics, and History & Social Science. In the English Language Arts section, there are 3 separate testing sessions. One session includes a composition, where the students are required to write a rough draft, and later they are asked to revise it and submit a final copy to be graded. The other sessions include a multiple-choice and an open-response section. Through these tests, students are tested on literary analysis, in which they must use their knowledge of literary elements, themes, and structures to analyze an excerpt from a literary text (DOE, 2001).

The grade 10 MCAS Mathematics test includes 39 multiple choice, 5 short-answer, and 7 open response questions. The Mathematics section tests students' ability to identify and apply properties of finite systems (for example, 2 x 2 matrices), modular systems, and defined operations. They should also be able to apply trigonometry to problem solving that involves right triangles, and be able to design a statistical experiment to study a problem (DOE, 2001).

The third section of the MCAS test is the History and Social Science section. It contains 42 multiple choice and 5 open response questions. In this section, the students are tested on world issues outside of the United States regarding such topics as government, geography, economics, and history.

All these sections, when completed, are sent to the Department of Education where they are scored by specially trained Massachusetts's scorers, often teachers (DOE, 2001). MCAS score guides are available in Appendix G.

Ultimately, the goal of the MCAS is to help educators refine their teaching skills and curriculum, as well as to help students monitor their progress. The MCAS is an annual examination given to students in all grades. The following table shows what subject areas are tested in each grade, as Table 2.1 (DOE, 2001):

Grades and Content Areas Tested in Spring 2001

Table 1. MCAS 2001 Tests

Grade Tested	*Content Area Tested*				
	English Language Arts		Mathematics	Science and Technology/Engineering	History and Social Science
	Composition (Writing)	Language and Literature (Reading)			
3		X			
4	X	X	X		
5				X	X
6			X		
7	X	X			
8	X*	X*	X	X	X
9				(see note)	
10	X	X	X	(see note)	X

* This will be the final administration of the grade 8 English Language Arts test (both components).

NOTE: The one grade 10 MCAS Science & Technology test administered in previous years will be replaced in the future by six content-specific tests to be taken by students in grades 9 and 10. Separate tests will be given in the five areas of biology, chemistry, physics (introductory), earth science, and technology/engineering, and an integrated science test will be given that includes biology, chemistry, physics, and earth science. Question Tryouts in these content areas will take place in the spring of 2001. Please see chapter V, section C of this document for further information.

Figure 2.1: Grades and Content Areas Tested in Spring 2001

All students attending state funded public schools must take the MCAS exam. Students in charter schools, as well as students with learning disabilities or limited English skills are also required to take and pass English Language Arts and Mathematics sections of test in order to graduate. Migrant students who have lived in the United States for more than three years must take the test as well. Because of the background of the MCAS and its high standards, much controversy has risen regarding its validity and reform usage. We have included sections of the Grade 8 and 10 MCAS test sections in both English and Math for reference (see Appendices C-F).

2.3 MCAS Controversy

After being implemented since 1998, the MCAS has been accompanied by a great deal of controversy. There are three main issues involved in the MCAS controversy: its difficulty level, its use as a school review tool, and its implementation as a graduation requirement. The test is believed to be the most difficult examination in the country by the Massachusetts Teachers Association (MTA) and other associations, evident by its very low passing rates and argued high standards. In addition to a student assessment test, the MCAS is also used for school review in assessing teacher and curriculum qualities. Furthermore, its new use as a graduation requirement brings much attention and discussion amongst students, teachers, and politicians as well.

2.3.1 MCAS Test Difficulty

The first of the three main MCAS controversy issues, the test's difficulty, is indicated by its considerable failure rates. Of the 10^{th} grade students who took the test in spring of 2000, 34% of them failed the English Language Arts section, 45% failed the Mathematics section, and 37% failed the Science/Technology section (DOE, 2001). More dramatically, urban high school failures were "roughly double that rate" ("MCAS solutions," 2001).

Studies have been carried out to compare the MCAS test to other national examinations, such as the 2000 National Assessment of Educational Progress, in order to gauge its difficulty. In this national exam, Massachusetts "fourth-graders tied for the top score in the country, and eight-graders tied for fifth place" (Vaishnav, 2001a, p.B1). These same students, however, performed extremely poorly on their native MCAS test, where 39 percent of the eighth graders failed the math section (Vaishnav, 2001a).

The Massachusetts Commissioner of Education, David Driscoll, who is largely in charge of the education reform process, declares that the test is valid because the MCAS points out the areas in which students need help. With no plans of lowering its difficulty level, he states: "If the conclusion is we're holding kids to slightly higher standards…so be it" (Vaishnav, 2001a, p.B1). He supports the test's objectives by stating: "The [Curriculum] Frameworks and MCAS are designed to raise the academic achievement of all students in the Commonwealth" (DOE, 2001).

Mass Insight, an independent, non-profit Massachusetts organization focused on increasing student achievement in public schools, agrees that the test portrays valid standards for students to strive for. This group feels that the test will help improve student ability to read, write, and calculate, as well as imposing values of teamwork and responsibility, as the Common Core intended (Mass Insight, 2001). The MCAS will help students have hopeful futures and earn better jobs, as well as prepare them for college level work, through high standards and expectations (Mass Insight 2001).

Others disagree, however, including the National Center for Fair and Open Testing (also known as Fairtest), an anti-MCAS group from Cambridge, Massachusetts. Fairtest states that the "MCAS math exams are absurdly difficult. They are apparently made especially difficult in order to fail many children and make the public schools look bad" (Vaishnav, 2001a, p.B1). Boston College education professor Albert Beaton supports this notion, stating: "The MCAS people ought to look carefully at their standards to see if they are really defensible" (Vaishnav, 2001a, p.B1).

The Massachusetts Teacher Association (MTA), an organization of 94,000 teachers across the state advocating quality public education, believes that students have not yet had sufficient exposure to the material on the test (MTA, 2001). According to the this organization, educational reform standards have only been in effect for a few years now and are still changing; therefore it is unfair to test students on this material. Also, the MTA feels low-income schools will be unable to teach to these standards due to lack of resources, such as teachers and funding (MTA, 2001).

2.3.2 MCAS as a Tool for School Review and Curriculum Reform

The Massachusetts Board of Education had previously utilized a School Performance Rating System to review its schools through the MCAS. This system rated each school with a number from 1 to 6, based on their 1998 MCAS scores. A high rating of "1" indicated that the school had performed very well, with 80% or more students in the Proficient or Advanced category and less than 5% at the Failing category; while a rating of "6" indicated that at least 60% of students were scoring in the Failing category (MTA, 2001a, par. 5). Depending on this rating, each school's average MCAS score was then expected to improve in subsequent years by a certain amount. The school's 1999 and 2000 scores are averaged together, and compared to the 1998 score. A school with a rating of "1" in 1998 is expected to increase its MCAS score by 1-3 points, while a school with a "6" is expected to increase by 5-7 points (MTA, 2001a, par. 5).

Driscoll supports the validity of the system as a method of school review, stating: "The whole idea of the school rating system is to measure schools based on improvement…It's much fairer in that sense" (DOE, 2001e, par. 7). Juliane Dow, of the Department of Education, declares that the new rating system "will identify both schools that are doing exceptionally well and schools that seem to be having trouble meeting the standards…to help us focus our attention and our efforts where they are most needed" (DOE, 2001f, par. 50). Under this new rating system, 56% of all Massachusetts schools received an "F" for "Failing to Meet" the state standards for improvement this past spring, and would need to be placed under review (MTA, 2001a).

School personnel have reacted towards the School Performance Rating System, declaring it to be invalid. Teachers such as James Doyle, a retired math teacher from West Springfield, feel that the system is unjust and "mathematically wrong." He states: "What they did was an eighth grade math mistake" by averaging the averages of MCAS scores to judge improvement (MTA, 2001a, par. 15). Mr. Doyle declared that the system should take into account the number of students who took the test each year, which can vary by a "statistically significant amount" and can alter the findings greatly (MTA, 2001).

Other teachers are reacting in a similar fashion, believing that the system is flawed. Bill Kendall, head of the mathematics department in Braintree, denounces the system through this statement:

> "One thing we notice in Braintree that is evil is that your improvement expectations were based on the MCAS scores in your first year. Some schools had weaker students the first year and they improved greatly. Others had stronger groups in that first year, and then they looked like

> failures. It's just absurd to create a system like this" (MTA, 2001a, par. 14)

Even MCAS supporters, such as Superintendent of WPS Dr. Caradonio, are critical of the new rating system. "These ratings were not helpful at all," he states, "It's fuzzy math, bad statistics and horrible sampling. No businessman or woman would use a system like this" (MTA, 2001a, par. 18).

As school and teacher reviews are conducted, it is feared that teachers will be forced to teach primarily the content on the MCAS tests, and to replace their tried-and-true curriculum. Critics of the test agree that "spending more class time on MCAS will simply turn courses into test preparation exercises" (Vaishnav, 2001b). Gary Burton, the Superintendent of Schools in Wayland, Massachusetts, reminisces upon a past debate on the mathematics curriculum framework:

> It pitted a group of practicing math teachers who sought an increased emphasis on developing conceptual and procedural knowledge against a group of politicians and state officials supporting improved computational skills. The teachers lost the debate and currently the MCAS math tests accentuate correct answers over higher order thinking skills (Burton, 2001)

The MTA feels that too much emphasis on the MCAS leads to omission of "innovative, in-depth, inquiry-based teaching methods in favor of content 'coverage' in order to prepare students for the MCAS" (MTA, 2001b, sect. 3). Valuable time that is wasted on teaching the MCAS material could be spent on "quality education" (MTA, 2001b, sect. 3). Building on this notion, Fairtest feels that the "MCAS tests encourage young people to skim the surface and memorize material they will soon forget" (Fairtest, 2001a, par. 3). Many schools, they believe, have already adopted the short term goal of teaching to raise test scores, while simultaneously depriving students the skills and knowledge that they will need for their futures (Fairtest, 2001).

Some believe that educational reform will succeed, having confidence that the state government is well equipped to handle this reform, and that higher academic standards as well as regulated teacher licensing will improve the educational system greatly (Burton, 2001). Other teachers believe the MCAS rightfully holds students to college level standards and prepares them for higher education. Tom Sherman, a math professor at Northeastern University, wishes "students to have the sense that mathematics can be used for things other than mathematics... [They] don't think to use the concepts they just learned in other settings" (Mass Insight, 2001a, p. 2). In accord with him is James Kaput of University of Massachusetts, Dartmouth, who declares that colleges are looking for students who do more than just compute numbers. He states: "MCAS assumes a different curriculum, and it's the curriculum that higher education would like to see" (Mass Insight, 2001a, p. 2).

2.3.3 MCAS as a Graduation Requirement

New legislation requires the class of 2003 to be the first class whose graduation requirement will include passing the MCAS, in the English and Mathematics sections. Students who initially fail the exam will have a total of four more chances to pass the exam before their diploma is withheld.

Although some parents do not oppose the MCAS as a graduation requirement, the idea of a single high-stakes test worries them. In a recent poll done by the MTA, parents are found to "favor a testing requirement over no requirement at all, but clearly [favor] 'multiple measures' over a single test" (MTA, 2001).

The MTA believes that a single test cannot accurately measure a student's ability. "High-stakes" decisions (the graduation requirement) should not be based on a single test, but instead on multiple measures, they argue (MTA, 2001b, sect.1). Furthermore the MTA believes that the Education Reform Law declared a need for a multiple assessment requirement, and thus the MCAS violates this act (MTA, 2001). Fairtest also disapproves of the consequences that high-stakes testing imposes, stating that the MCAS will not fairly assess different ethnic groups or students with learning disabilities or language barriers.

The Department of Education is planning to develop a proposal that would allow some students to graduate, despite having failed the MCAS. Alan Safran, the Deputy Commissioner of Education, states that a proposal would award diplomas if "they have adequate grades in core subjects, attend classes, and take advantage of remedial courses" ("MCAS solutions," 2001). The plan would be limited to students who are within a few points of passing (Greenberger, 2001a). While some believe that this "way out" is an acceptance of mediocrity and degradation of high standards—including Driscoll, who originally had no intent on lowering the difficulty levels—others believe it to be a sound idea (Greenberger, 2001a).

This new proposal has been considered in fear of denying diplomas to high-achieving students who fail the MCAS. "Withholding diplomas from mediocre students is politically problematic," Greenberger states, "but refusing to grant them to good ones would be a political disaster" (2001a). This proposal includes lowering the minimum passing score on the test, as well as omitting the hardest items from the exams on subsequent retests. Students who fail the test within a few points can now appeal to a "regional panels of educators" who would judge the appeal based on student grades, as well as student scores on other standardized tests, and letters from teachers (Greenberger, 2001a). This new proposal has not yet been passed, and is still subject to further review and comment.

Education Commissioner Driscoll, however, does not believe the proposal will lead to anything too dramatic, stating: "I think you're talking about 1,000 people at the most…I don't believe the process is going to stretch like taffy" (Greenberger, 2001b, p.B3). Charles Baker on the other hand, a Board of Education member, believes that the proposal will lower the passing score enough that appeals won't be necessary for students to pass (Greenberger, 2001b).

2.4 Past and Current Studies of the MCAS

Since the MCAS' induction in 1993, published studies regarding its validity and content are available on most topics of discussion. Most of the public's view of the MCAS has been documented in newspaper articles. A great deal of information can be found online concerning the MCAS, such as its comparison with other standardized tests including the SAT-9. Correlation studies between the MCAS and SAT-9 scores revealed similar trends in gender performance as well as ethnic performance.

There have been some previous Interactive Qualifying Projects (IQPs) done by Worcester Polytechnic Institute (WPI) students on this topic. One such IQP, entitled "MCAS and the MBTI: Explorations," was designed to study the outcomes of scores based on students' personality from the Myers-Briggs Type Indicator test (McElhaney, 2001). "The indicator," or better known as the MBTI, is a psychological tool designed to determine personality types. This test observes behavior as not being random, but instead following identifiable patterns that are derived from the structure of the human mind. Due to time restrictions and redrafting of the final report, this project did not reach its conclusion; rather it drafted conclusions, along with 40 other pages of discussion that were not yet ready for publication.

Another IQP entitled "Analysis of MCAS Scores in Massachusetts" studied several factors that may have affected the MCAS scores of schools across Massachusetts (Quinteros and Radhakrishnan, 2001). They analyzed factors such as per capita income, per pupil expenditure, and teacher salary, to determine if any correlation existed between them and student scores. Also studied were any potential correlations between ethnicity and student scores. The purpose of this hypothesis was to determine if there were any connections relating the ethnic groups of Asian, Black, Hispanic, Native American, White, and Mixed to MCAS results. Demographics were also considered, including school location and size (Quinteros and Radhakrishnan, 2001). In their conclusions, they stated that the MCAS is in fact a true measure of what the Curriculum Frameworks entails. They also concluded that standardized testing is the best tool available to determine if the entire public school system is performing at an acceptable level (Quinteros and Radhakrishnan, 2001). One conclusion of some importance was that there was no correlation between teachers' salary and student performance.

Another IQP entitled "MCAS Score Improvement" studied the effectiveness of a 4th Grade Mathematics After-hours MCAS Program at Adams Street School

(Chandrashekhar, 2000). It aimed to create an after school program in the 4th grade to help prepare students for the mathematics portion of the MCAS. The students were taught MCAS type math questions for one week, and after that week they were assessed for improvement by a sample MCAS test from the previous year. The tested students showed improvement in math comprehension, but did not show revealing improvement on open-response type questions. (Chandrashekhar, 2000).

2.5 Recent Test Performance

In the spring of 2001, MCAS scores improved dramatically when compared to previous years. Statewide performance showed a significant increase in test scores, with a decrease from 34% to 18% failure rate in the English Language Arts section and a decrease from 45% to 25% failure rate in the Mathematics section (McFarlane, 2001b). Some feel that this improvement is because the class of 2003 is the first required to pass the MCAS in order to graduate from high school.

The Worcester Public Schools also showed improvement, as expected. Although they fell from 196th to 199th out of 211 in statewide district rankings, scores improved in all areas of the MCAS evaluation. The percent failing improved from 62% to 41% in Math, and improved from 51% to 34% failing in English. Worcester performed higher on the 2001 MCAS test than both Boston (205th) and Springfield (209th) (Vaishnav, 2001d).

Although most schools increased in performance, some schools did not improve as well. For example, the Patrick F. Gavin Middle School in south Boston improved slightly in math and performed worse on English. The principal, Joseph Lee, describes a possible reason: "A significant number of eighth-graders entered the [school] that year lacking basic skills...It was a very difficult class. It came in low, and it wasn't the cohort group of kids who were here for the three years" (Boston Globe, 11/2/01).

Reasons for improvement vary. State education officials ensure that scoring methods have remained the same, stating that "changes in the way they scored the exams didn't inflate the results" (Vaishnav, 2001c). Some feel that the success rate is higher because "the nearly 70,000 10th graders who took the test in the spring knew they must pass to graduate in 2003" (Maguire, 2001). Jeanne Elie, a student, concurs by stating: "I don't think we're smarter—I think we want to leave high school...we don't want to stay" (Vaishnav, 2001d). "What the results last week showed is that everyone tried," quoted Heidi Perlman, the Education Department spokeswoman (Vaishnav, 2001d).

Teachers were also credited for student performance. Student Sandy Verneus said she passed "because of all the preparation [the teachers] did for [the students], and the special classes and the after-school programs" (Vaishnav, 2001d).

Active protests were also minimal for this exam. In spring 2000, 30 % of the 10th graders of Cambridge Rindge and Latin School boycotted, compared to only two or three students in spring 2001 (Maguire, 2001).

Current concerns include directing attention towards those who failed simply because they refused to take the test. In spring 2001 approximately 4,200 students refused the exam (Vaishnav, 2001d). David Driscoll aims to find those students and introduce them to remedial programs. "If we identify them and offer programs," he states, "we may in fact be helping kids who may be potential dropouts" (Vaishnav, 2001d).

The racial gap is also still a concern. In Boston, for example, 81 percent of the white 10^{th} graders passed math, while only 41 percent of the black 10^{th} graders passed (Vaishnav, 2001d). A similar pattern existed with Latino students, who performed lowest overall. We will be looking at demographics, including ethnicity, in our analysis of WPS MCAS scores.

3. Methodology

3.1 Introduction

The goal of our project was to study the effects of student mobility on MCAS scores. We studied two groups (referred to as "cohorts") of 8th graders, one from each of the '97-'98 and '98-'99 school years, as they each moved onto the 10th grade two years later. These students were of the class of 2002 and 2003, respectively. We then compared students within the cohorts and determined which students departed or entered the WPS, defined as "mobile," and which students remained in the WPS system throughout these academic years, defined as "non-mobile." The effects of student mobility were then studied, as well as the identification of any possible trends.

Our objectives were to:

1. Collect the data for the MCAS results
2. Organize and analyze the data using advanced software programs, consisting of SPSS, and Microsoft Excel and Access
3. Use statistical methods to form mathematical conclusions about possible trends and patterns relating student mobility and MCAS test scores
4. Find possible reasons for student mobility by contacting principals and distributing a questionnaire

Our methodology discussion first names and details different methods we used in our project. Then we discuss our procedures for collecting and analyzing our data. Lastly, we formulate any expected results that we hope to prove.

3.2 Methods

3.2.1 Data Collection and Compilation Procedures

Almost all of our information was provided by our project liaison, Patricia Mostue, the Director of Testing and Assessment of Worcester Public Schools. She receives all of the district's MCAS data, which was available to us upon our request. These data were in spreadsheet format, which could be analyzed with Microsoft Excel and Access, or the SPSS statistical analysis package. The data included the MCAS results for each grade and year we studied. Each cohort of students was required to take the MCAS in 8^{th} and 10^{th} grades. We first organized a total of four lists: a list of 8^{th} graders who took the test in 1998 and a corresponding list of 10^{th} graders who took the test in 2000, these two lists referred to as students in ("cohort 1"); and a list of 8^{th} graders who took the test in 1999 and a corresponding list of 10^{th} graders who took the test in 2001, these two lists referring to students in ("cohort 2"). The data sets listed each student's score for each time they took the test, as well as basic information such as student name and identification number, gender, age, and demographic information. Each student had been given a district student identification number when they entered the Worcester Public School system, which was found to be very useful in matching data.

Most of the time spent on data collection and compilation involved a great deal of reorganizing the database and fixing errors. There were a significant number of records missing student ID's, as well as including duplicate records, and spelling mistakes in student names. Using the Student Attendance Grading Enrollment (SAGE) information database, a database that stores information on all students in the Worcester Public

Schools, the lists were crosschecked to make the necessary corrections. Students who had missing or obscure ID numbers were manually searched for in the SAGE database by their name, and if found their ID numbers were then inserted. There were a variety of other different flaws and complications as well. One cohort list, for example, contained an additional two digits before every student's ID number, signifying the code number of the school of the student. These two digits were removed with Microsoft Excel.

Another cohort list contained all of the basic information but the results of only the English Language Arts portion of the MCAS. The Mathematics portion was supplied in a separate list, yet this list lacked the student ID numbers. Microsoft Access was used to match two lists based upon a shared variable in both lists, such as an identification number, and then generate one compiled database that contained information from both lists. We were attempting to compile each of our four lists with student ID numbers included, as to facilitate easier data analysis later on with Access. For this cohort, student ID numbers were absent in one of the datasets, and thus students' first and last names were used to match the data. Using this process we found both duplicate records (as more than one student may have the same first and last names) and some names that could not be matched.

The duplicate records in the database were removed manually with the help of Access. The names that would not match were due to spelling mistakes and inconsistencies in student names. Some students spelled their names differently on each list (e.g. "Jennifer" and "Jen"), others included additional abbreviations (such as "Jr." or "III"), while others were simply spelt incorrectly (e.g. "Stephen" and "Steehen"). Since the names would not match up exactly, Access would not recognize them and would overlook them. Using their date of birth as a reference, we crosschecked both lists to verify that the student in question was the same, and manually corrected their names. Access then re-matched the names afterwards with much more success. Roughly one-fifth of this list contained these spelling errors.

Two cohorts contained a "SASID," which is a "state assigned student ID," but not their local district ID. Therefore, Patricia Mostue supplied a list of SASID's with their respective local district ID. Access was then used to insert a new column into these two cohorts that contained to district student ID numbers.

Some students in each list were not recovered when the data were organized. Many students were not found in the SAGE database when we were searching for them. Each of the cohort lists did not supply some the student names, leaving blank spaces or "name not provided." When matching the cohort list whose English Language Arts and Mathematics sections were separate, it was found that some students took only one portion of the test, and were removed. Furthermore, when matching the SASID's with the local district ID's, some students were not supplied with a SASID nor were they found in the SAGE database, and were therefore lost. The 8th grade lists had approximately 1500 students each and only a few students were lost in the compilation. For the 10th grade lists, which had 700 and 1,400 students, no more than 20 students were lost in each list.

3.2.2 Data Analysis Procedures

To analyze these data Microsoft Excel and Microsoft Access were used. These programs could easily organize and tabulate students in any desired fashion, such as by school or by gender.

To best utilize these data in ways we could easily understand and interpret, descriptive statistical methods of analysis were used. Since mean (or "average") test scores for the different grade levels were being compared, multiple independent populations were being studied: students who leave the cohort, students who remain non-mobile through 10^{th} grade, and students that enter the cohort and take the MCAS in 10^{th} grade.

Microsoft Access was used to link the databases of 8^{th} and 10^{th} graders for each cohort, to search for those students ID's that were in the 8^{th} grade list but did not reappear in the 10^{th} grade list. This group of students took the 8^{th} grade MCAS but for some reason did not remain in the WPS to take the 10^{th} grade MCAS, and were considered mobile (outgoing). Next, Microsoft Access was used to determine which student ID's appeared for the first time in the 10^{th} grade. These students thus joined this cohort between 8^{th} and 10^{th} grade, and were considered mobile (incoming) as well.

To determine the effects of mobile students on overall test scores, we first analyzed the 8^{th} grade results of each cohort by comparing the mean non-mobile student scores to the mean mobile student scores. This was done to determine whether the outgoing students scored differently when compared to non-mobile students. This analysis was also done for the 10^{th} grade students as well, to determine the difference in mean scores between the incoming and non-mobile students. We produced frequency diagrams for students' performance levels, to further analyze student trends.

SPSS, a Microsoft Windows based statistical analysis software, was used to perform the statistical analysis. This software was only available to us through a fully working demo version, which was downloaded online. It was a very user-friendly program that allowed us to perform all of our necessary statistical tests. SPSS was unable to read Microsoft Access databases, however, and as a result Access databases were first exported into Excel spreadsheet format before SPSS could be utilized.

The first task accomplished was a mean score comparison of the mobile and non-mobile students for each cohort. SPSS provided us with the mean score comparison, as well as standard deviations of the two means. The standard deviation describes the distribution of the values within the data. For example, if the standard deviation of the mean test scores was low, a randomly selected student would tend to score near the overall mean score. On the contrary, if standard deviation was high, the randomly selected student's score could vary much differently from the overall mean score.

Frequency plots were also constructed using SPSS to analyze our cohorts by test score and performance level. These plots indicated the percentage or quantity of students who scored in a certain test score or performance level. Each student is given a performance level on the MCAS based on their test score: Failing, Needs Improvement, Passing, or Advanced. These frequency plots helped further analyze the distribution of test scores and to recognize any trends. We also used frequency plots to compare students performance based on other demographic characteristics, such as free lunch, race, gender, and school attended.

A linear regression was performed using SPSS to predict scores for the non-mobile students, to imitate zero mobility. This method attempted to relate the non-mobile student scores in 8th grade to their respective scores in 10th grade, to determine a mathematical formula. This formula was used to estimate a student's 10th grade MCAS score based on his/her 8th grade score. SPSS formulated this information very quickly for this analysis. With this formula, we then incorporated all of the students in the 8th grade, including the mobile students, and predicted their potential mean score in the 10th grade, as if they had been present for this test. This test therefore predicted scores assuming mobility did exist—if no students left the school system after 8th grade or entered before 10th grade.

To create this formula, we first needed to select an independent variable, which was the 8th grade score in either English Language Arts or Mathematics, and a dependent variable, which was the 10th grade score in the corresponding subject. SPSS then generated coefficients for the regression formula. The formula produced is of form $y=mx+b$. In this formula, y is the dependent variable (the 10th grade scores), m is the ratio between the two variables (the 8th and 10th grade scores), x is the independent variable (the 8th grade scores), and b is the offset value which represents the average difference between the two variables.

To determine the validity of the regression formula, we determined the R-values and significance levels of the test. R represents the correlation coefficient, a number assigned to measure linear correlation between two variables (in this case, 8th grade and 10th grade scores). The higher the value of R, the more significant our study can be regarded. Furthermore, R^2 values were found as well, which represent the magnitude of validity in our test. A test with an R-value of 0.700 or higher is considered to have high significance.

Significance level denotes the probability that our test is in error. For example, if significance level is 0.05, then we are more than 95% confident that the correlation is valid.

3.2.3 Reasons for Mobility

Another aspect of our study included a general questionnaire that was given to select principles of Worcester High Schools in order to discern the major cause of student mobility. Various reasons for mobility were given to us by Dr. Mostue and were then organized into a Microsoft Word document. This document contained a list of students that left the Worcester Public Schools, as well different reasons for mobility. The principle was asked to investigate each student we provided and check off the current known reason for the student leaving. A copy of this questionnaire is available in Appendix J

4. Results and Analysis

The results of the data organization resulted in two major data lists for each cohort: 8^{th} grade and 10^{th} grade MCAS scores for each student in the Worcester Public School system, along with pertinent demographic information as well (including gender, race, and school attended). We were unable to retrieve every student from the original lists we were given after matching ID numbers with the students for this analysis. From each student list we were unable to retrieve about 20 students at most—less than 1% of the entire list.

Dr. Mostue also informed us that the 2001 MCAS data were flawed, as Harcourt, the company that corrected the tests, had lost some of the test sections submitted by the students, and gave failing grades to many students. These errors could not be remedied during the project period.

Some students did not take either one or both portions of the test, as tabulated in section 4.2, and thus there was no score to analyze. As a result our analyses did not include these students, and only the students who took both portions of the test were tabulated. Also, other important factors including gender and ethnicity were not included in the data we received, and could not be recovered through matching with the SAGE database. As a result, the number of students in each of the following studies varies, as only the students with values for the studied variable were included.

4.1 How Many Students are Mobile and Non-mobile?

After matching up the two lists of 8^{th} grade and 10^{th} grade MCAS results, we were able to successfully discover which students were mobile (present for only one of the two

MCAS tests) and non-mobile (present for both tests). If a student ID number was found in both lists he/she was automatically considered non-mobile. Figures 4.1 and 4.2 below display the breakdown of student mobility for cohorts 1 and 2, respectively. The numbers indicated the number of students. Non-mobile students are shown in both grades, while mobile students (outgoing or incoming) are shown in only one year. The left side represents the cohort in 8th grade, while the right side represents the same cohort in 10th grade:

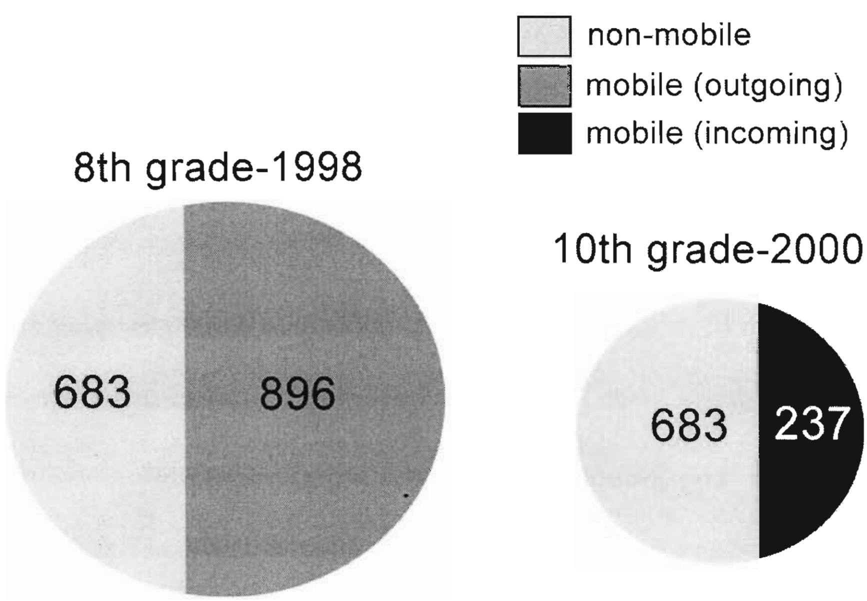

Figure 4.1 – Cohort 1 mobility breakdown

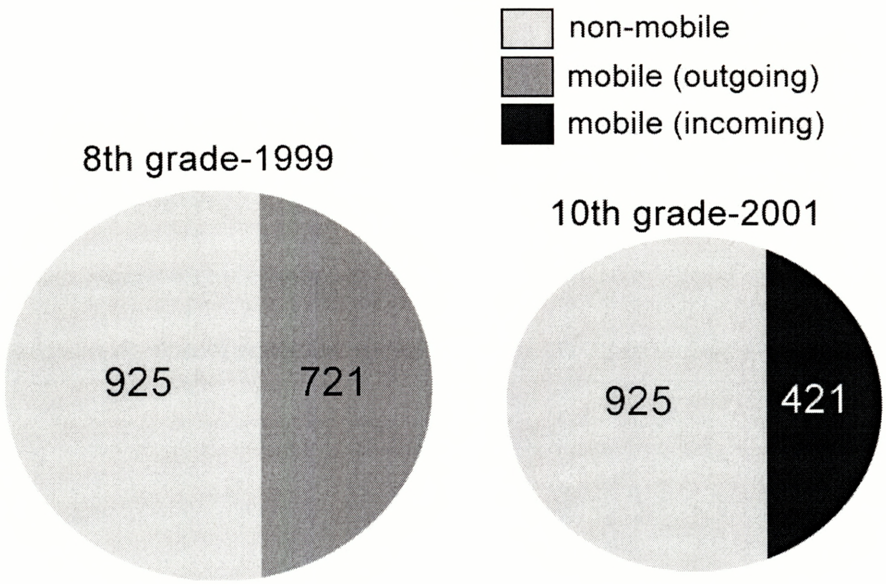

Figure 4.2 – Cohort 2 mobility breakdown

Apparently there are an enormous number of students who leave the Worcester Public School system after 8th grade, as well as enter the school system before 10th grade.

4.2 How Does Mobility Affect MCAS Results?

First of all, we analyzed all of the students in each cohort and in each subject, to determine their mean scores distribution, ignoring mobility factors. This was done to analyze the MCAS results in Worcester Public Schools as a whole, without considering mobility. We found the following results, tabulated in Tables 4.1-4.4 below:

Table 4.1: Cohort 1—8th grade students in 1998

		ELA	MATH
# of students	Valid	1578	1579
	Missing	46	45
Mean		231.55	217.27
Std. Deviation		15.804	18.772

Table 4.2: Cohort 1—10th grade students in 2000

		ELA	MATH
# of students	Valid	666	671
	Missing	17	12
Mean		222.39	219.84
Std. Deviation		19.012	21.506

Table 4.3: Cohort 2—8th grade students in 1999

		ELA	MATH
# of students	Valid	1580	1597
	Missing	129	112
Mean		229.92	218.09
Std. Deviation		15.173	17.586

Table 4.4: Cohort 2—10th grade students in 2001

		ELA	MATH
# of students	Valid	1589	1578
	Missing	92	103
Mean		223.87	228.30
Std. Deviation		18.458	16.509

From these results, which analyze all students in each grade without accounting for mobility, there appears to be a large point difference between student scores in 8th grade and 10th grade. The English Language Arts (ELA) portion of the test declines by several points in each cohort, while the Mathematics section increases by several points.

Next, we studied the test score distribution based on student mobility. The lists were broken up into non-mobile, outgoing, and incoming students, and analyzed comparatively. This study, which is presented in the following two sections, consists of:

1. Comparing non-mobile student scores to outgoing student scores in the 8th grade
2. Comparing non-mobile student scores to incoming student scores in the 10th grade

4.2.1 Comparison of Non-mobile to Outgoing Student Scores in 8th Grade

Cohort 1:

In the first cohort, which took the 8th grade MCAS in 1998, we found that non-mobile students performed several points higher than outgoing students on both sections of the test. A summary of their scores is tabulated below as Table 4.5:

Table 4.5: Cohort 1—8th grade test summary

MOBILITY		ELA98	MATH98
outgoing	Mean	229.10	214.58
	# of students	869	870
	Std. Deviation	16.483	18.083
non-mobile	Mean	235.04	221.03
	# of students	683	683
	Std. Deviation	14.106	19.112
Total	Mean	231.71	217.42
	# of students	1552	1553
	Std. Deviation	15.756	18.810

There is a clear point difference between the outgoing and non-mobile students. Non-mobile students in this cohort have tended to score roughly 6 points higher than the outgoing students. As the outgoing students comprise 44% of the total student population, their scores lower the average MCAS score of the entire cohort significantly. We then created a frequency plot of the test scores, to further analyze the student scores and study the distribution. Performance level plots were also created to discover the classification of the students. These are displayed below in Figures 4.3-4.6:

Cohort 1: English Language Arts

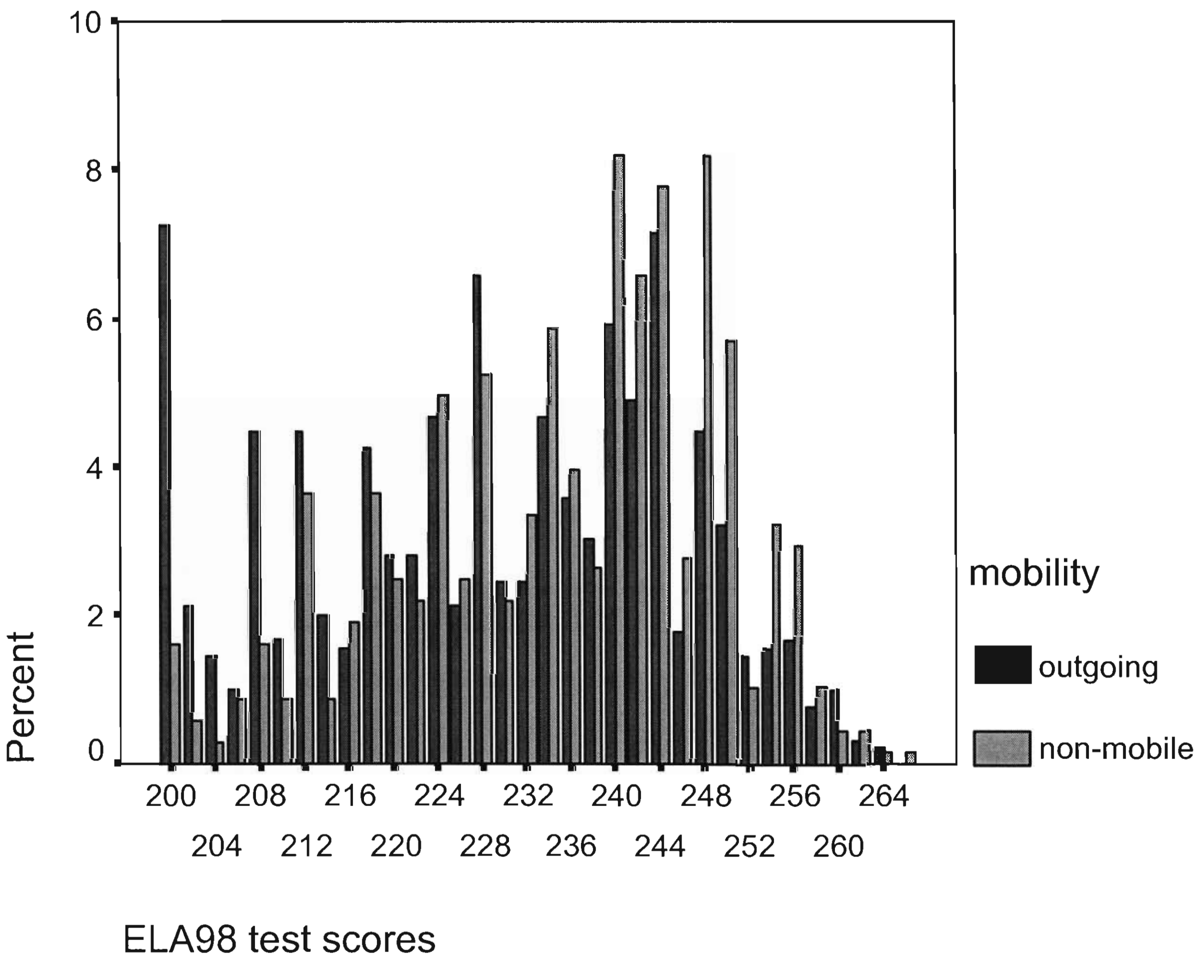

Figure 4.3: Cohort 1—8th grade frequency plot of student scores in ELA

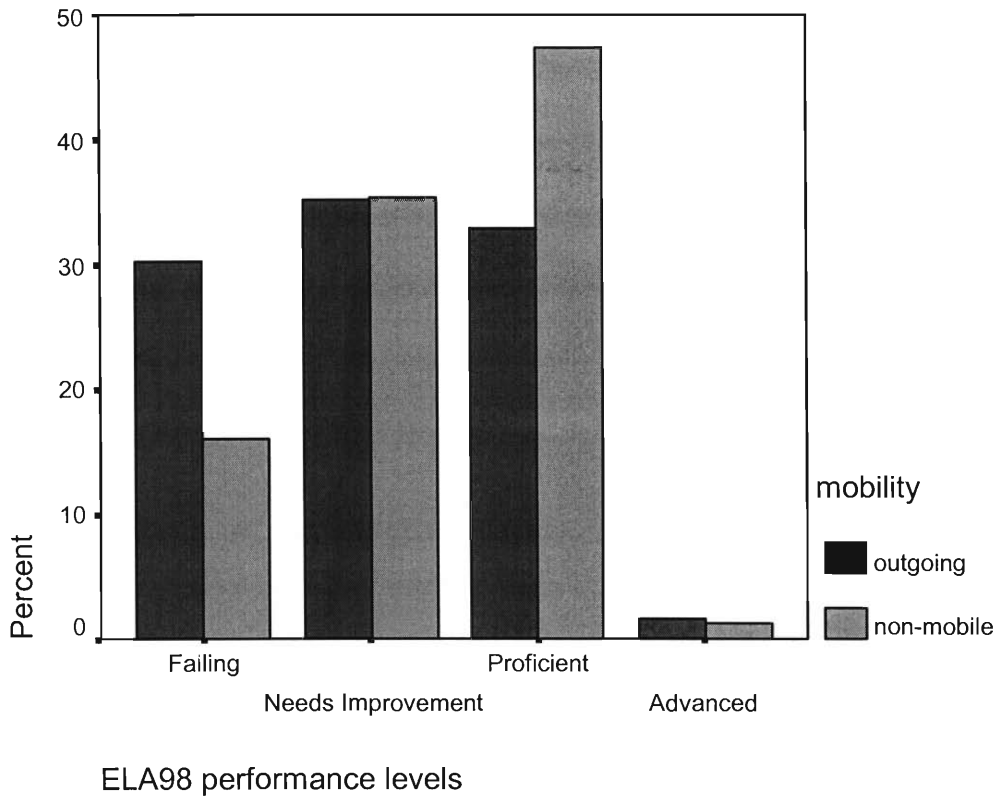

Figure 4.4: Cohort 1—8th grade frequency plot of student performance in ELA

In the ELA portion of the test, there is a high frequency of non-mobile students scoring in the higher test range of the MCAS, as evident in Figure 4.3. On the contrary, there is a high frequency of outgoing students scoring in the lower end of the test scores. These results are clearly reflected in Figure 4.4, where the majority of the non-mobile students (about 47%) score in the Proficient level, and most of the outgoing students (about 35%) are in the Needs Improvement level. A smaller percentage of the non-mobile students are in the Failing level (about 15%) than compared to the outgoing students (about 30%).

Cohort 1: Mathematics

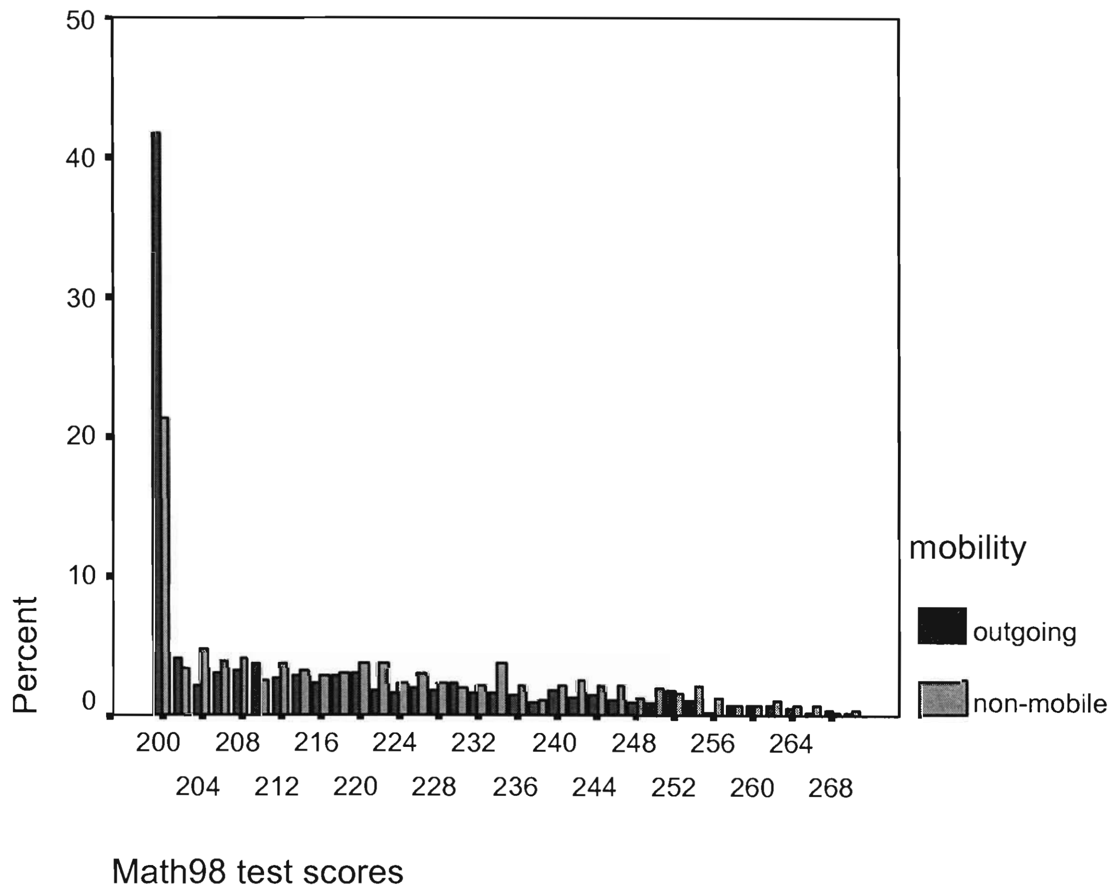

Figure 4.5: Cohort 1—8th grade frequency plot of student scores in Mathematics

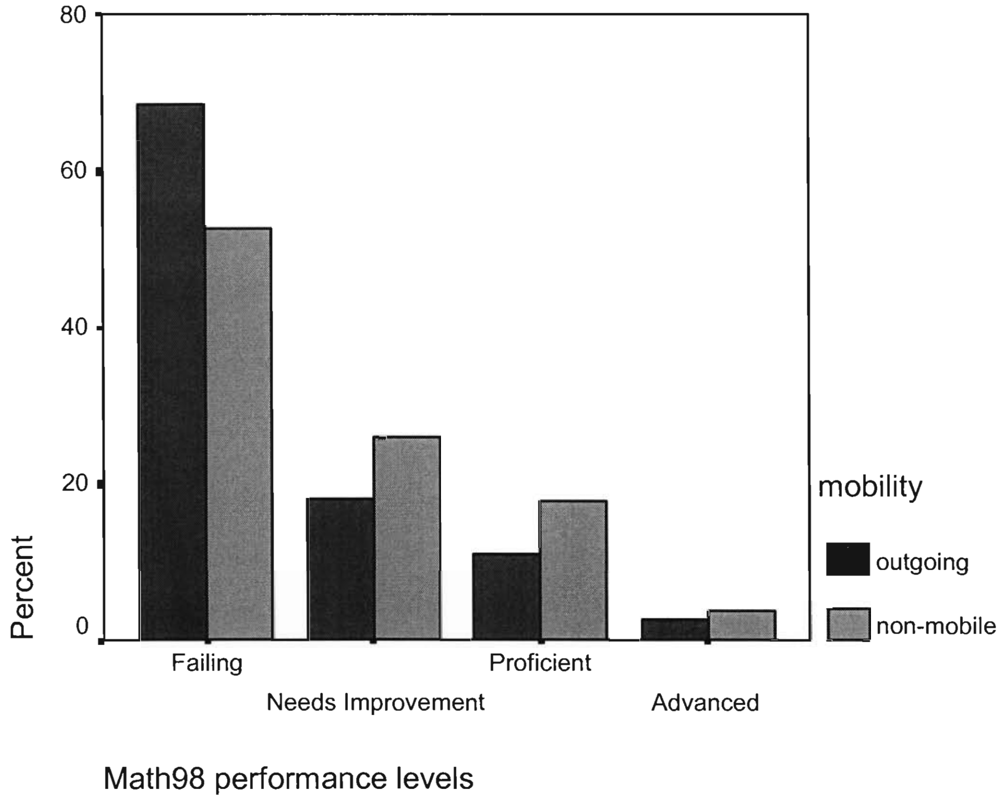

Figure 4.6: Cohort 1—8th grade frequency plot of student performance in Mathematics

In the Mathematics section of the test, there existed a very high percentage of students who received the lowest score of 200, as evident in Figure 4.5. About 42% of the outgoing students and 22% of the non-mobile students received this score, and as a result the mean values of the Mathematics section are skewed. These scores may have been a result of students who simply refused to take the MCAS and submitted the test without answers; or the students may have failed the test after a valid attempt. We were not able to determine the reason for the large number of students receiving a score of 200.

Cohort 1: Mathematics—Omitting 200-score

As a result, for this study we decided to omit the students who scored a 200 and repeat the analysis, as to eliminate this uncertainty and to analyze the remaining students. We found that the point difference was no longer as large for the Mathematics section, as tabulated below in Table 4.6:

Table 4.6: Cohort 1—8th grade Mathematics summary, ignoring score of 200

MATH98

MOBILITY	Mean	# of students	Std. Deviation
outgoing	224.83	511	17.385
non-mobile	226.74	537	17.651
Total	225.81	1048	17.540

There exists only about a 2-point difference after the 200-score is ignored. Furthermore, when the frequency plots are repeated, the outgoing and non-mobile students are very similar in distribution, as shown below in Figures 4.7 and 4.8:

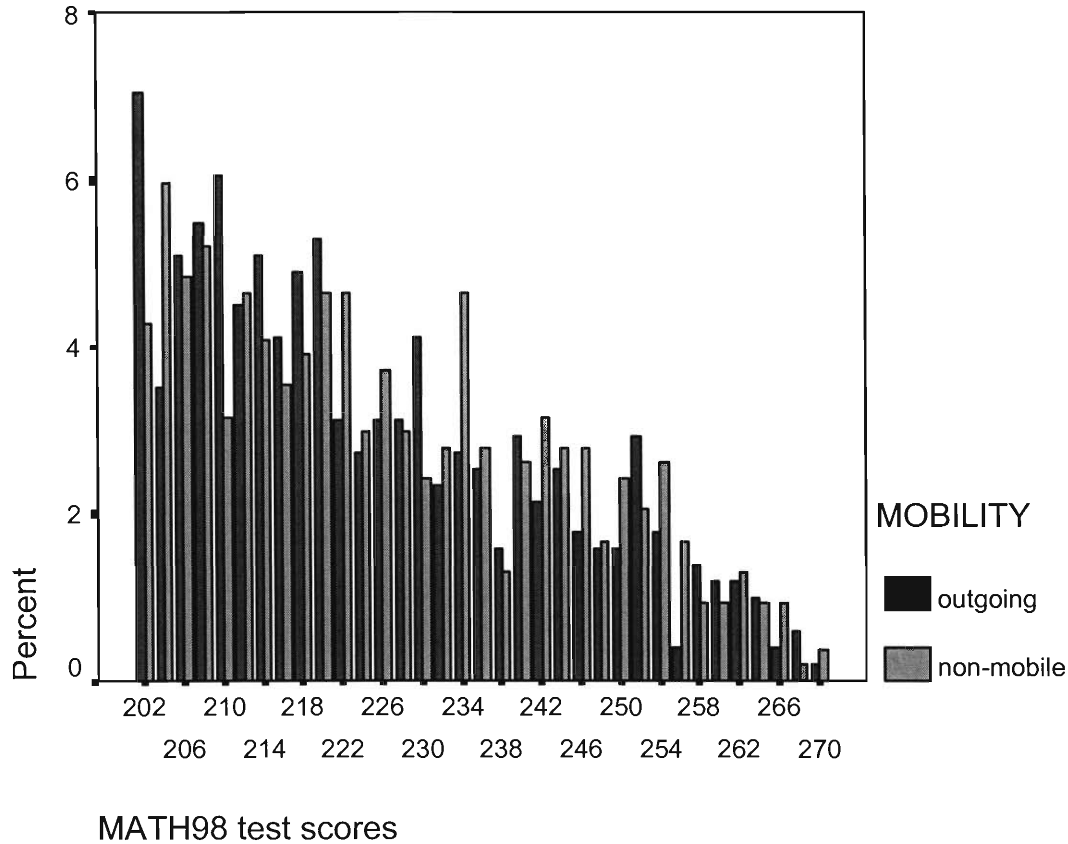

Figure 4.7: Cohort 1—8th grade frequency plot of Mathematics scores, ignoring 200 score

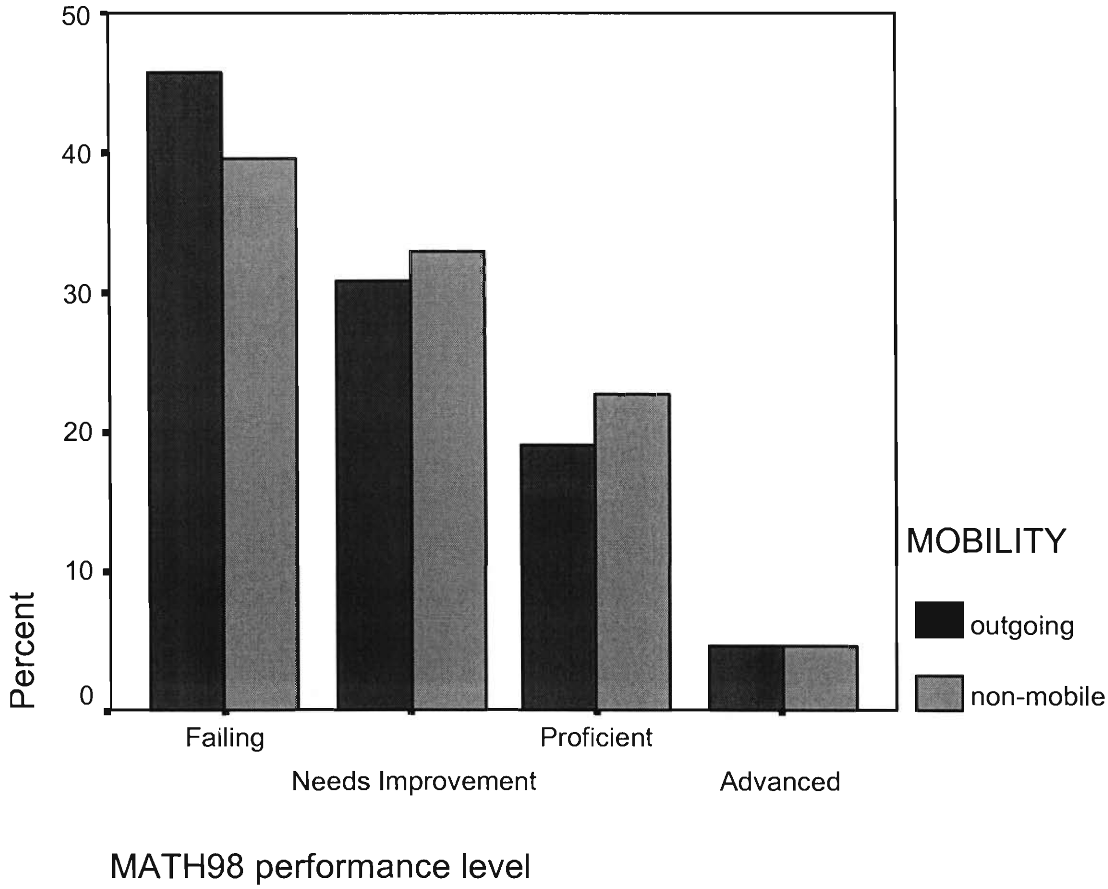

Figure 4.8: Cohort 1—8th grade performance level in Mathematics, ignoring 200 score

The point difference and frequency distribution differences are not as apparent in the Mathematics section of the test when compared to the ELA differences. The non-mobile and outgoing students appear to score very similarly as shown in the frequency plot of test scores in Figure 4.7. The performance level plot in Figure 4.8 also shows only minor differences as well.

Cohort 2:

Similar trends were evident in Cohort 2. The non-mobile students tended to score several points higher than the outgoing students. A summary of their results is tabulated below in Table 4.7:

Table 4.7: Cohort 2—8th grade test summary

MOBILITY		ELA99	MATH99
outgoing	Mean	224.92	213.21
	N	666	681
	Std. Deviation	15.300	15.909
non-mobile	Mean	233.76	221.81
	N	895	897
	Std. Deviation	13.936	17.888
Total	Mean	229.99	218.10
	N	1561	1578
	Std. Deviation	15.174	17.582

There is about an 8-point difference between the non-mobile and outgoing students in this cohort. The large number of outgoing students lowers the average MCAS score significantly. Frequency plots were created again to analyze the distribution of scores of the students, displayed and interpreted below as Figures 4.9-4.10:

Cohort 2: English Language Arts

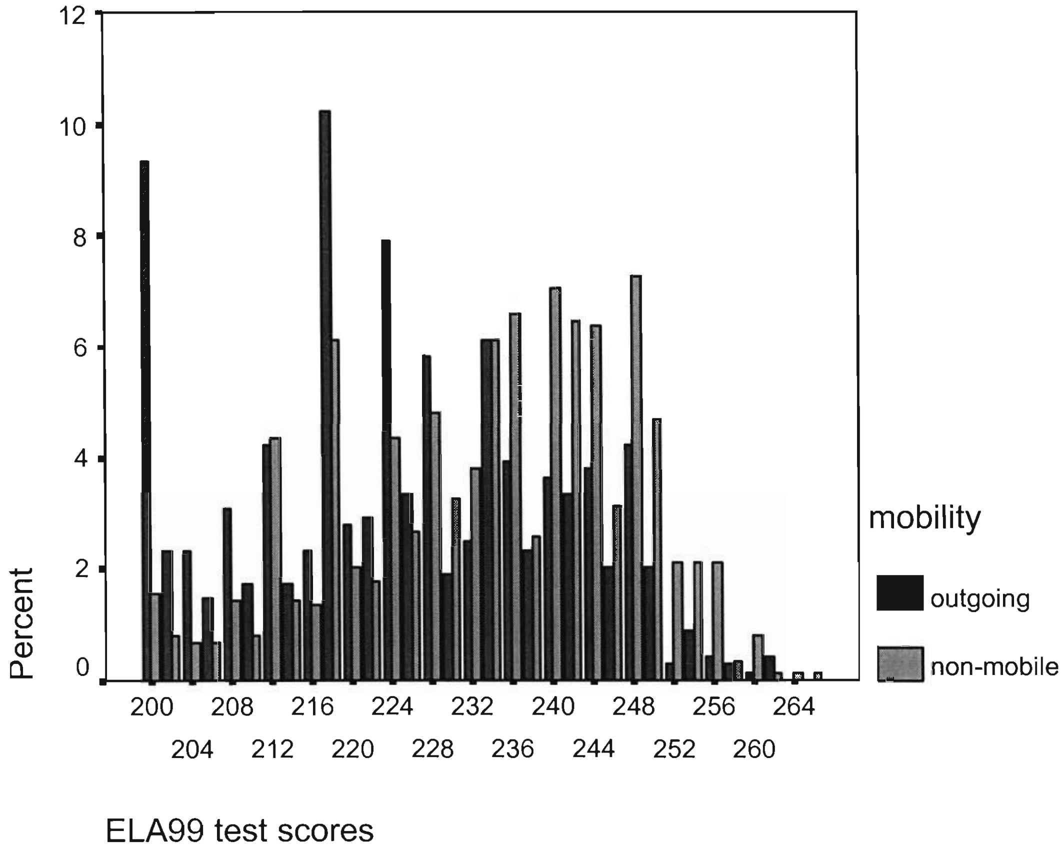

Figure 4.9: Cohort 2—8th grade frequency plot of student scores in ELA

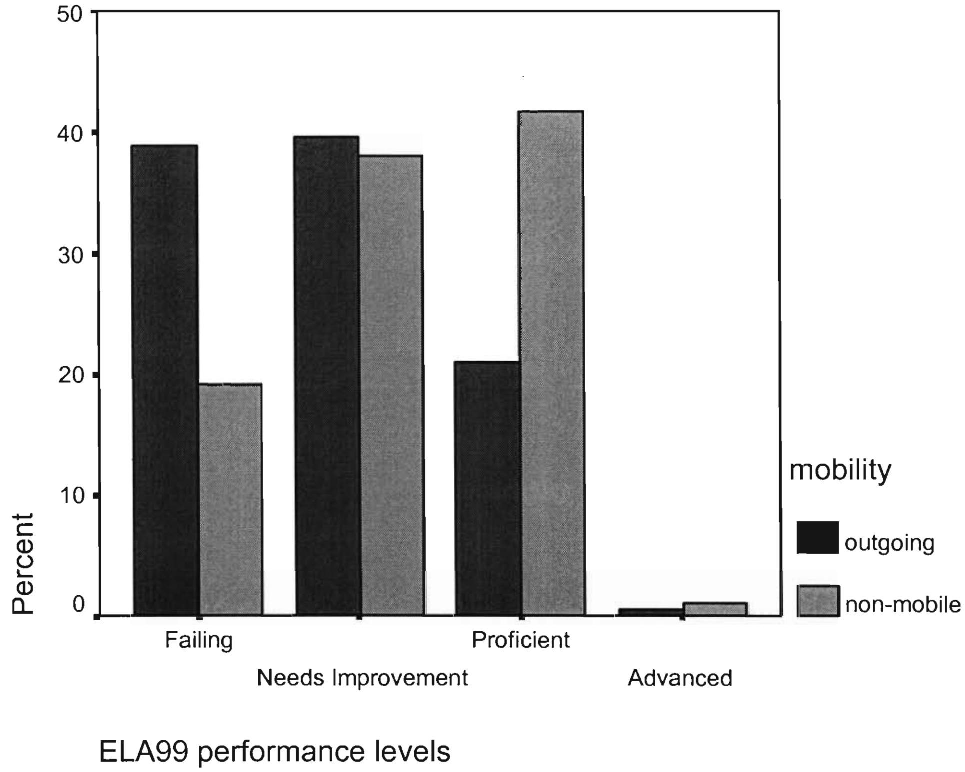

Figure 4.10: Cohort 2—8th grade frequency plot of student performance in ELA

The same trends appear here in Cohort 2 as they did in Cohort 1. There exists a high frequency of outgoing students in the lower end of the test scores, and also a high frequency of non-mobile students in the higher end. The majority of the non-mobile students score in the Needs Improvement and Proficient levels (about 38% and 42% respectively), while the majority of the outgoing students score in the Failing and Needs Improvement levels (about 39% and 40% respectively).

Cohort 2: Mathematics

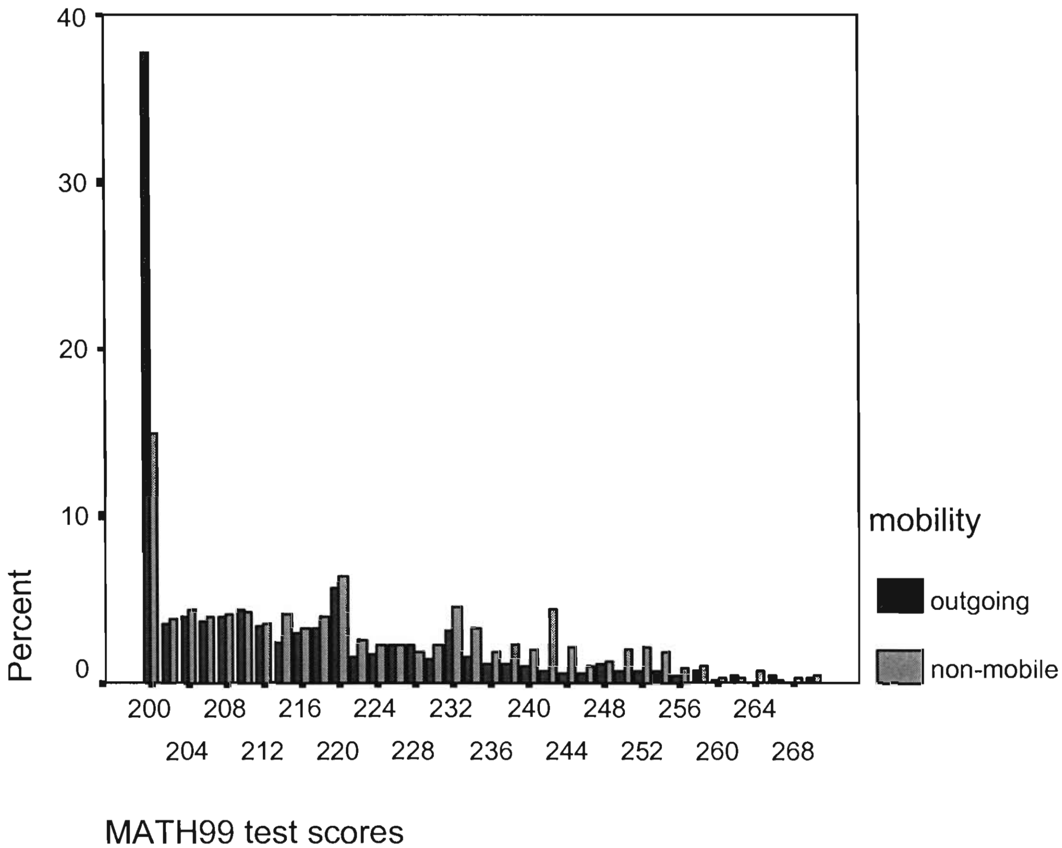

Figure 4.11: Cohort 2—8th grade frequency plot of student scores in Mathematics

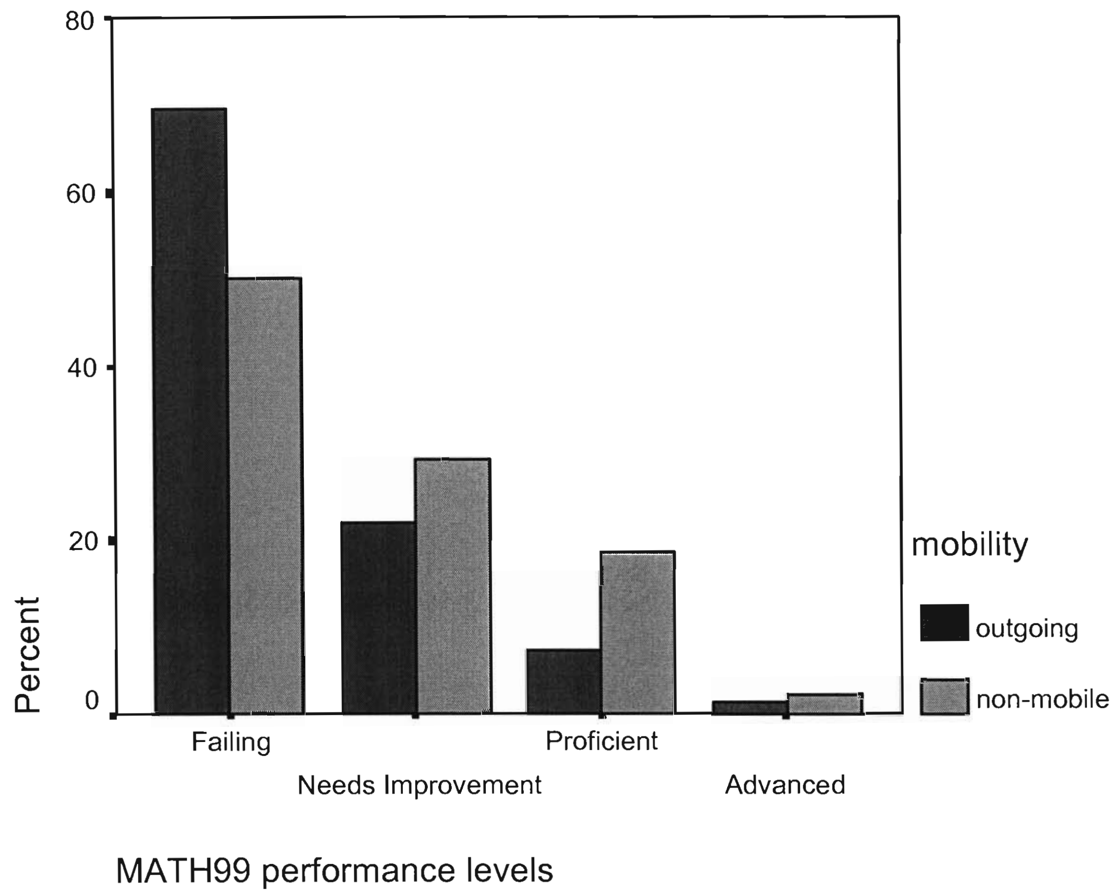

Figure 4.12: Cohort 2—8th grade frequency plot of student performance in Mathematics

The Mathematics results for Cohort 2 displayed similar trends from Cohort 1 as well. A tremendous percentage of both non-mobile and incoming students scored a 200 (about 15% and 37% respectively), thus skewing the mean score values.

Cohort 2: Mathematics—Omitting 200-score

The score of 200 was omitted from the data sets as was done previously, to study any further possible trends without this score. The results are tabulated below as Table 4.8:

Table 4.8: Cohort 2—8th grade Mathematics summary, ignoring score of 200

MATH99

MOBILITY	Mean	# of students	Std. Deviation
outgoing	221.26	423	15.367
non-mobile	225.64	763	16.670
Total	224.08	1186	16.346

The point difference is much smaller after ignoring the 200 score, but is still evident at about 4 points. The frequency plots below also show only a slight but notable point difference between the non-mobile and outgoing students:

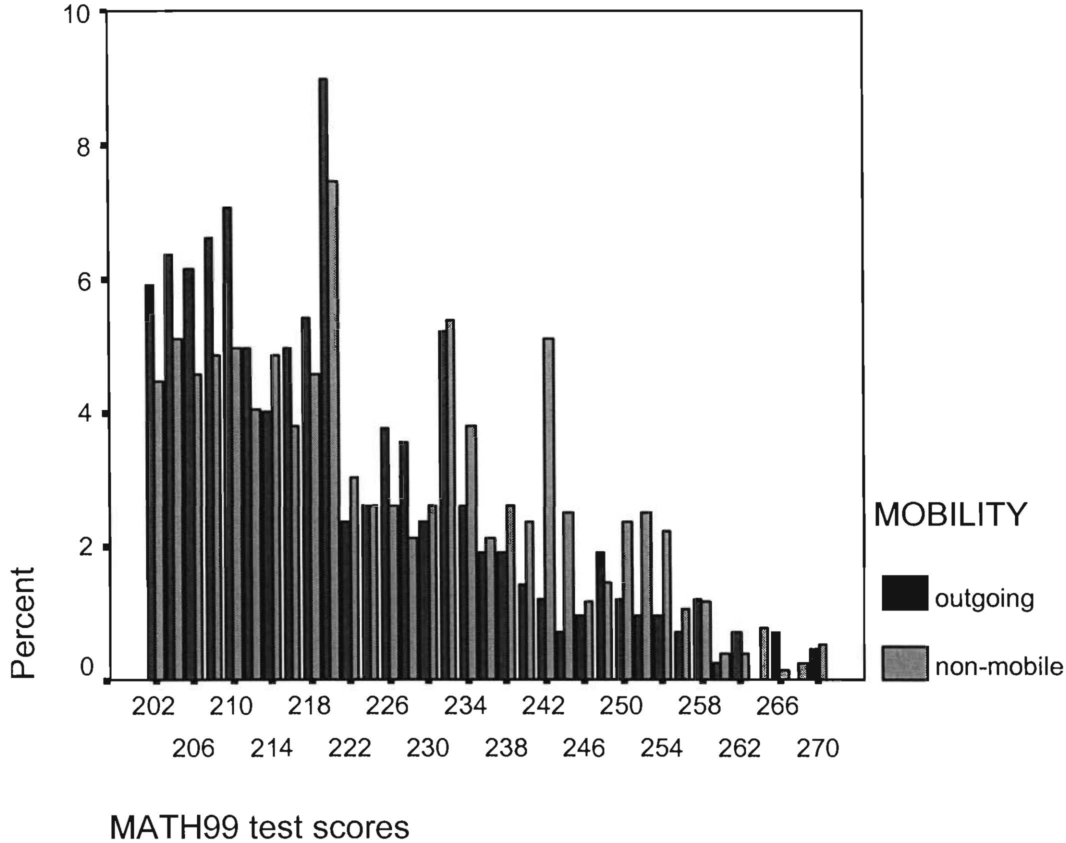

Figure 4.13: Cohort 2—8th grade frequency plot of Mathematics scores, ignoring 200 score

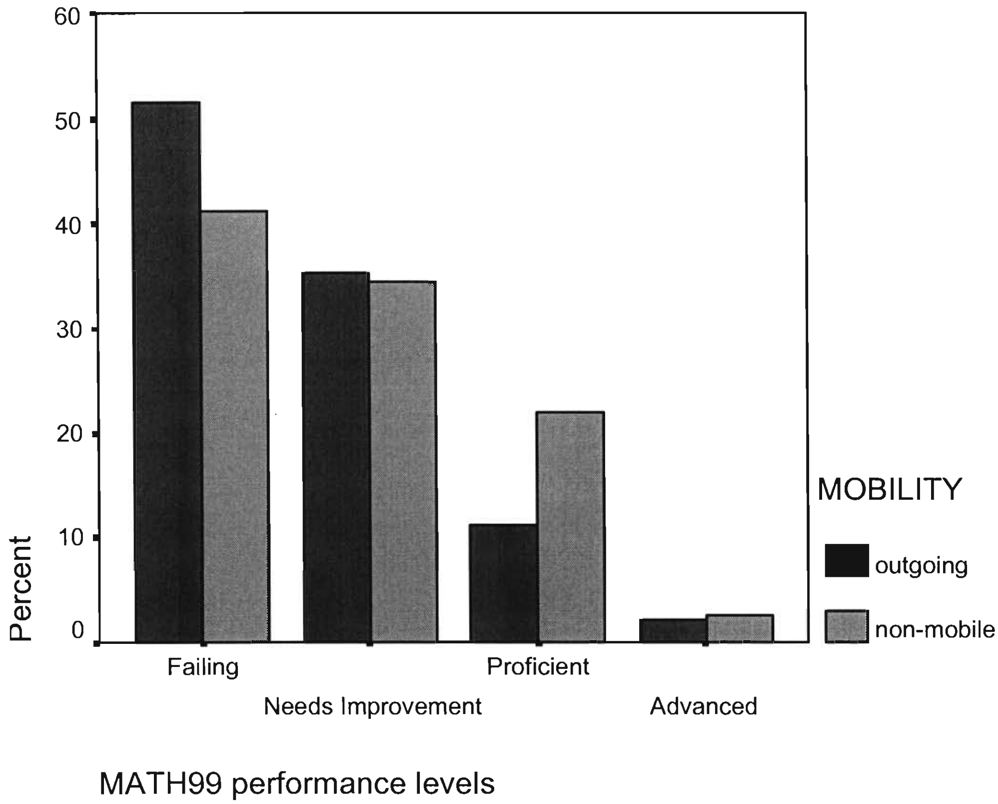

Figure 4.14: Cohort 2—8th grade performance levels in Mathematics, ignoring 200 score

The frequency plot in Figure 4.13 shows a trend where outgoing students have a slightly greater frequency in the lower end of the test scores, and non-mobile students are slightly greater in frequency in the higher end. This trend is much more subtle than from Cohort 1, but is still evident. The performance level rankings are also similar, though a higher percentage of the non-mobile students (22%, compared to 11% of the outgoing students) scored in the Proficient level.

Summary of 8th Grade Mobility Results

A large percentage of students were found to score 200 on the Mathematics section of the MCAS rest. Since this trend occurred in both cohorts and only in the Mathematics section, not in the ELA section, it can be reasoned that students found the Mathematics section more difficult than the ELA section. The ELA section test scores were evenly distributed and there did not exist a large frequency of the 200 score, and only the Mathematics portion showed this pattern. Quite possibly, students are more reluctant to take the Mathematics portion of the test and submitted an unanswered test, or this portion is more difficult. We were not able to discover correct reasons for this effect.

These comparisons showed that outgoing students tended to achieve lower scores than non-mobile students on the MCAS test. The point difference is more obvious in the ELA portion of the test than in the Mathematics portion, but the trend remains the same. As a result, these mobile students in the 8^{th} grade depress the overall MCAS average score. After the 8^{th} grade these students leave the school system and their scores no longer suppress the MCAS average in subsequent tests. As a result, if one were to analyze a cohort of students as they progress in the MCAS from the 8^{th} grade to 10^{th} grade, the outgoing students would suppress the mean score in 8^{th} grade, but not in 10^{th} grade, and the comparison would be affected greatly.

4.2.2 Comparison of Non-mobile to Incoming Student Scores in 10^{th} Grade

Cohort 1:

Students in the 10^{th} grade portrayed similar trends to those students in 8^{th} grade, with mobile students scoring lower than non-mobile students. Incoming students tended to have lower scores than non-mobile students by several points. In Cohort 1—those students who took the 10th grade MCAS in the year 2000—the test score summary is tabulated below in Table 4.9:

Table 4.9: Cohort 2—10th grade test score summary

MOBILITY		ELA00	MATH00
non-mobile	Mean	222.39	219.84
	# of students	666	671
	Std. Deviation	19.012	21.506
incoming	Mean	215.62	212.99
	# of students	175	185
	Std. Deviation	18.896	19.704
Total	Mean	220.98	218.36
	# of students	841	856
	Std. Deviation	19.175	21.305

For both subjects, the non-mobile students have scored on average about 7 points higher than incoming students. There are fewer mobile students in the 10th grade than in the 8th grade, however, and therefore the overall mean score is not significantly suppressed by the mobile students. The frequency plots of the tests scores and performance levels of this cohort are displayed below:

Cohort 1: English Language Arts

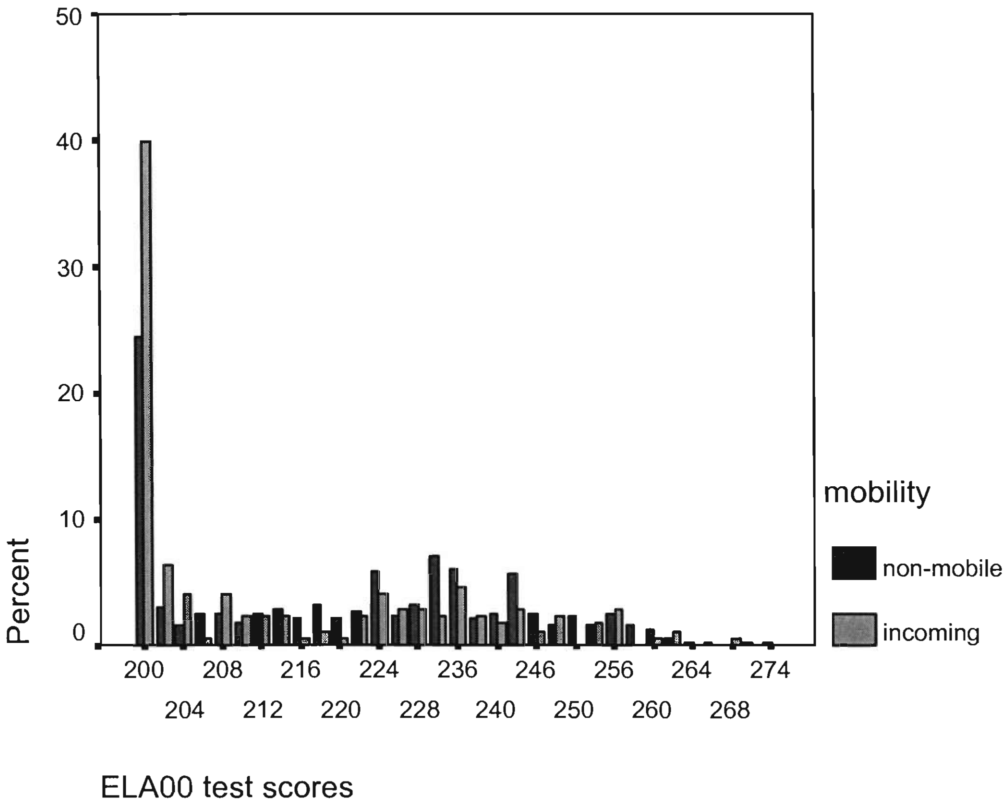

Figure 4.15: Cohort 1—10th grade frequency plot of ELA test scores

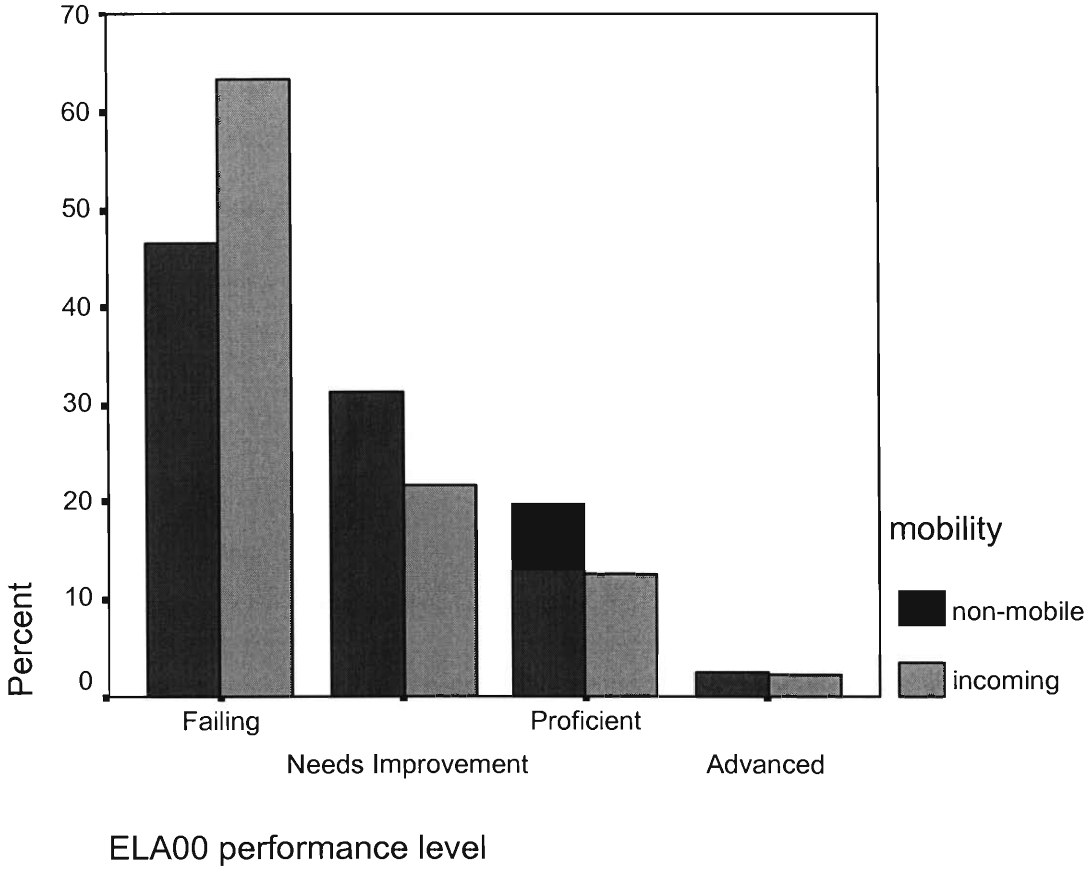

Figure 4.16: Cohort 1—10th grade performance level in ELA

From the frequency plot of Figure 4.15 it can be seen that there is a high frequency of the 200 score, much like the Mathematics results in the 8th grade, which skews the average score noticeably. About 40% of the incoming students and 24% of the non-mobile students received this score. The 200 scores were then ignored and the study was repeated, to further test for possible trends and patterns, as tabulated below in Table 4.10 and analyzed in Figures 4.17 and 4.18:

Table 4.10: Cohort 1—10th grade ELA test score summary, ignoring 200 score

ENG00

MOBILITY	Mean	# of students	Std. Deviation
non-mobile	229.64	503	16.228
incoming	226.04	105	17.989
Total	229.02	608	16.586

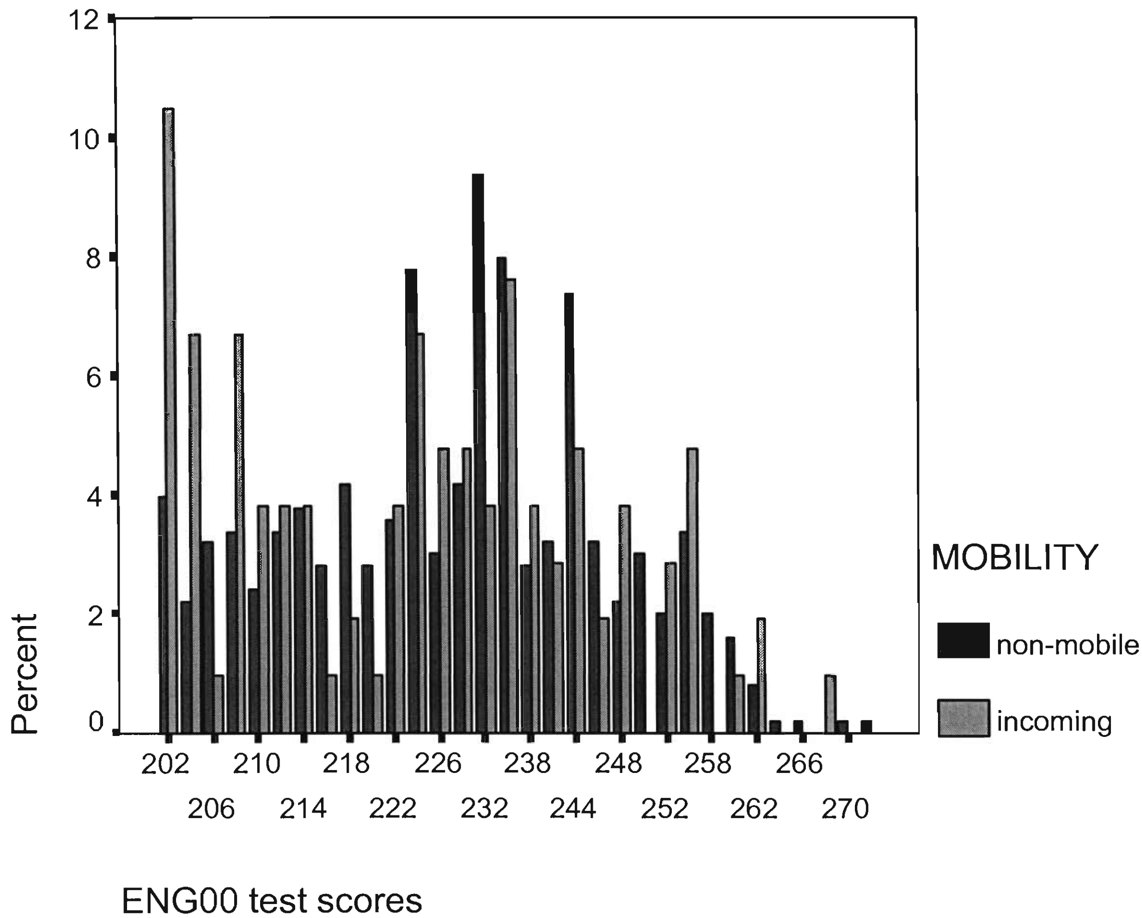

Figure 4.17: Cohort 1—10th grade ELA test score frequencies, ignoring 200 score

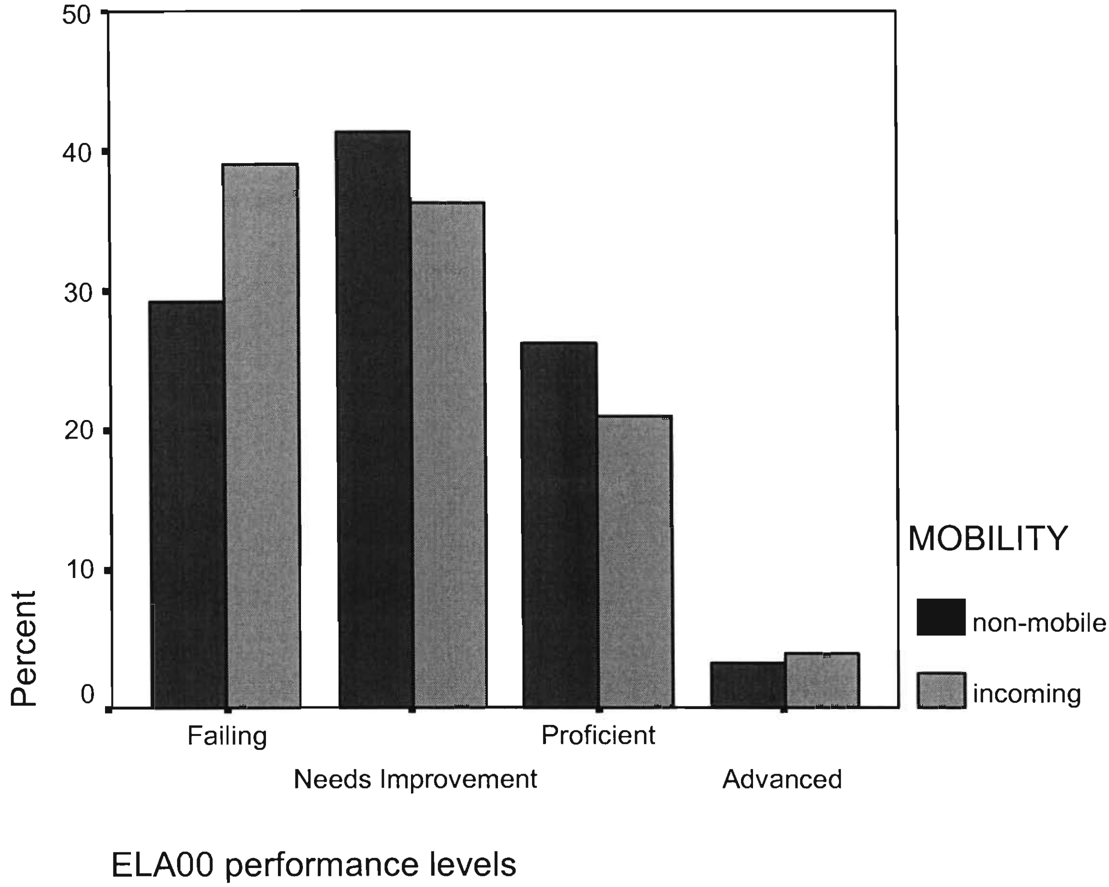

Figure 4.18: Cohort 1—10th grade ELA performance levels, ignoring 200 score

As shown in Table 4.10, the point difference between incoming and non-mobile students is only about 3.5 points when the scores of 200 are ignored. This is only a minor difference and is unsubstantial. The frequencies of the tests scores are fairly similar, as displayed in Figure 4.17. A higher frequency of non-mobile students scored within the Needs Improvement level, while incoming students scored more frequently in the Failing level. However, these differences were minor and the students appeared to score similarly if the score of 200 was ignored.

Cohort 1: Mathematics

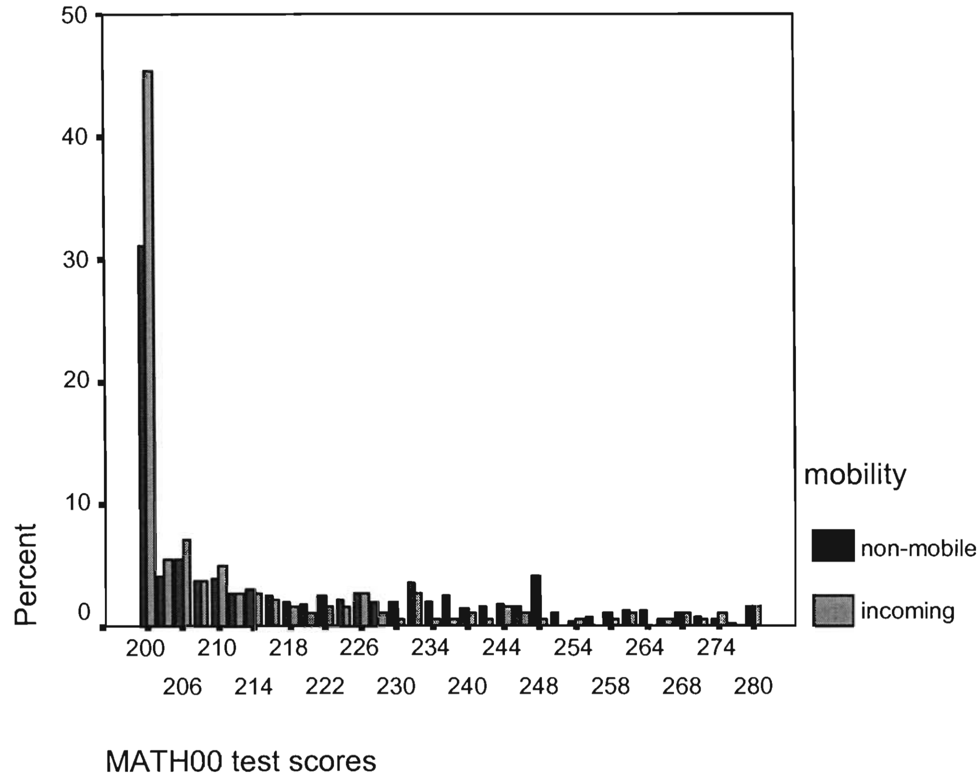

Figure 4.19: Cohort 1—10th grade Mathematics test scores

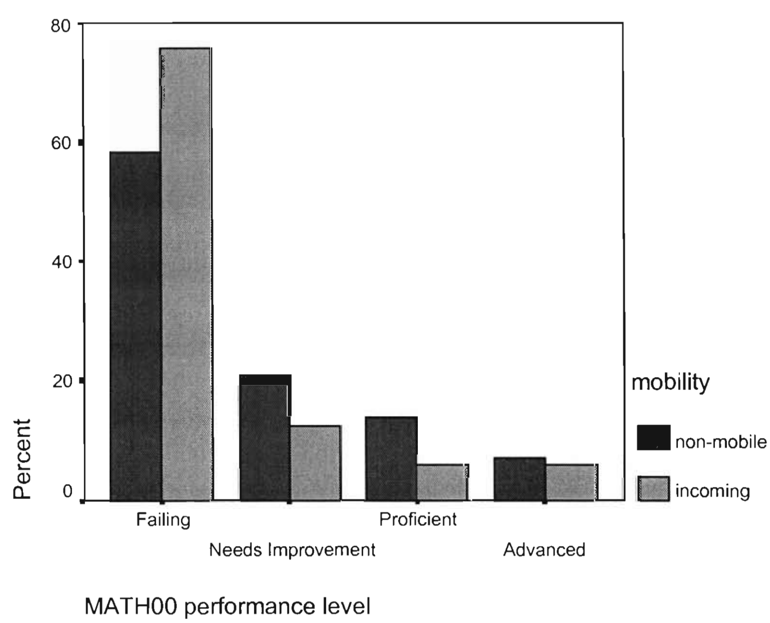

Figure 4.20: Cohort 1—10th grade Mathematics performance levels

The Mathematics frequency plot in Figure 4.19 shows a large amount of students with the score of 200—about 45% of the incoming students and 32% of the non-mobile students. These students were then ignored and the study was repeated, to study trends of the remaining students. The results are tabulated below in Table 4.11 and displayed in Figures 4.21 and 4.22:

Table 4.11: Cohort 1—10^{th} grade Mathematics test score summary, ignoring 200 score

MATH00

MOBILITY	Mean	# of students	Std. Deviation
non-mobile	228.81	462	20.325
incoming	223.80	101	21.321
Total	227.91	563	20.578

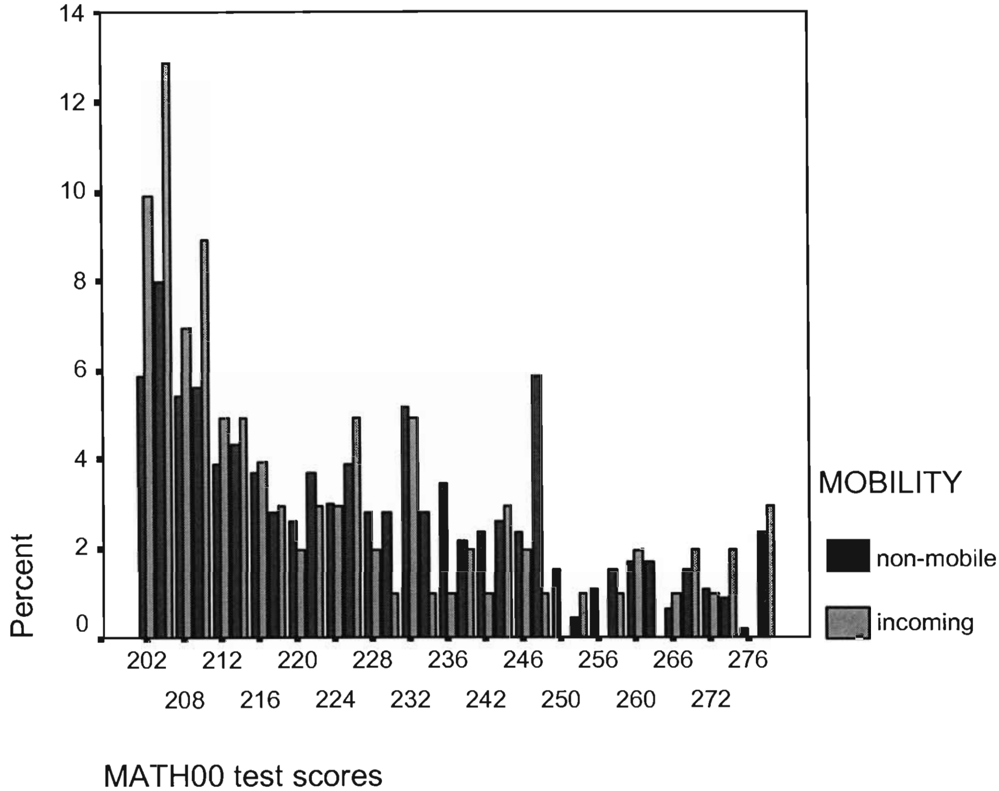

Figure 4.21: Cohort 1—10th grade Mathematics test score frequencies, ignoring 200 score

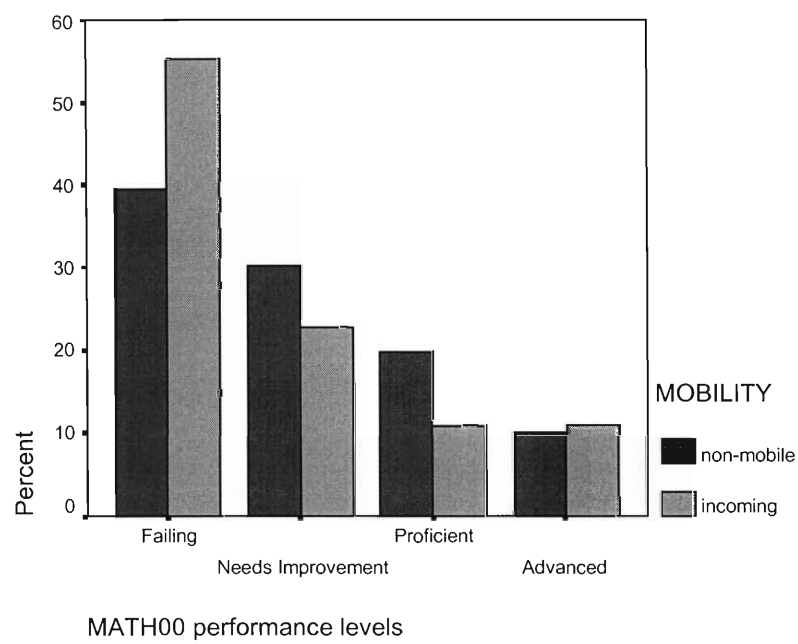

Figure 4.22: Cohort 1—10th grade Mathematics performance levels, ignoring 200 score

After ignoring the 200 score, the point difference between the incoming and non-mobile students became slightly smaller, reduced to about 5 points. A majority (about 55%) of the remaining incoming students received failing scores. The two groups scored very similarly throughout the remaining performance levels, though a higher percentage of the non-mobile students scored within the Needs Improvement and Proficient levels.

For this cohort, when we ignored the score of 200, incoming students and non-mobile students appeared to be very similar in their MCAS test scores. Non-mobile students still tended to score higher than the incoming students slightly, but the point difference was decreased. However, the students with the scores of 200 affect the validity of this comparison. This score cannot be ignored, as many of these students may have truly failed the test. It was not possible for us to determine which students attempted to take the test, as opposed to those who refused to take it for a particular reason. It would also be difficult to determine the validity of those students who simply signed their name and demographic information and left the remaining exam blank, and if they should be included in the study. We believe that the point difference will be substantial and relevant if the students who validly took the test were included in the analysis.

Cohort 2:

Student scores in Cohort 2 also showed a trend of non-mobile students scoring higher than incoming students. These students were administered the MCAS as 10^{th} graders in 2001. The test score summary is tabulated below in Table 4.12:

Table 4.12: Cohort 2—10th grade test score summary

MOBILITY		ELA01	MATH01
non-mobile	Mean	232.04	230.82
	# of students	893	897
	Std. Deviation	15.952	16.978
incoming	Mean	223.95	222.23
	# of students	344	370
	Std. Deviation	15.122	15.545
Total	Mean	229.79	228.32
	# of students	1237	1267
	Std. Deviation	16.132	17.021

The point difference between non-mobile and incoming students was about 8 points in each subject. The frequency plots of the test scores and performance levels are below:

Cohort 2: English Language Arts

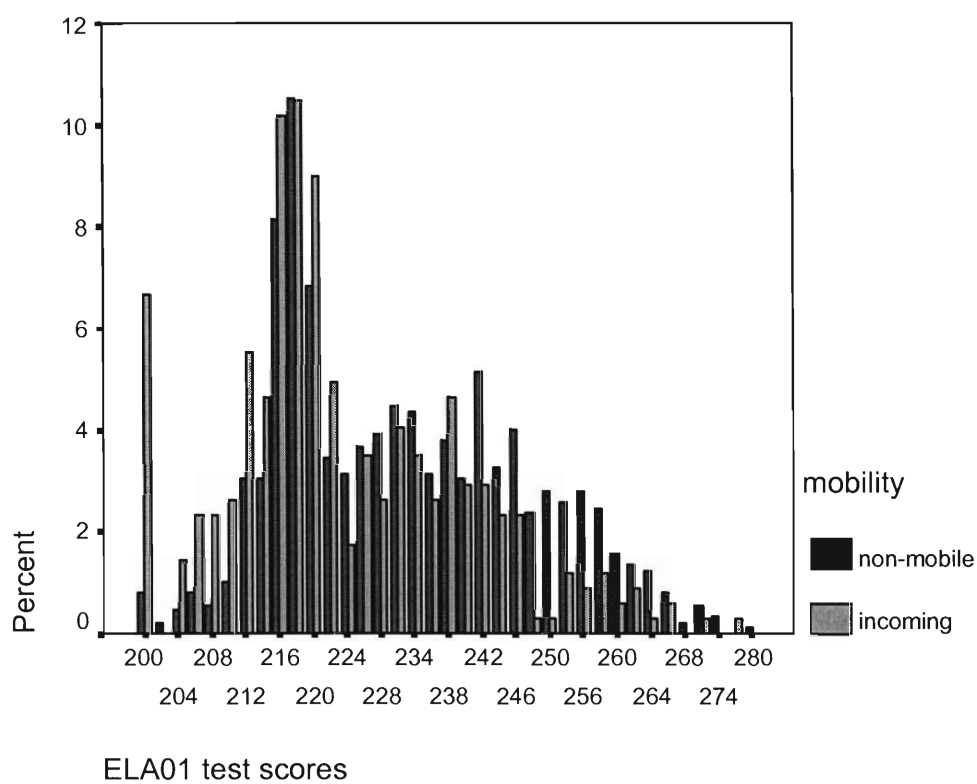

Figure 4.23: Cohort 2—10th grade ELA test score frequencies

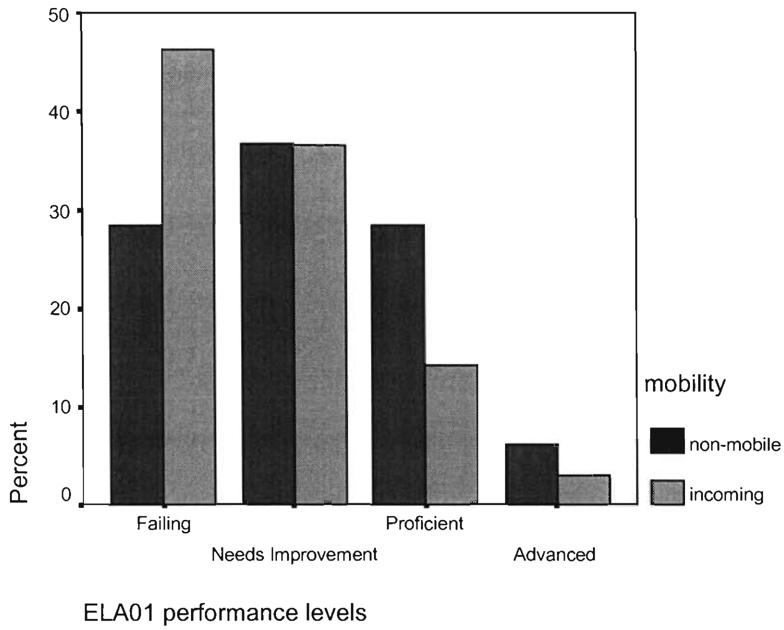

Figure 4.24: Cohort 2—10th grade ELA performance level frequencies

The frequency plot of Figure 4.23 shows a majority of students from both the non-mobile and incoming groups scoring at 216 and 218, which are slightly below a passing score. However, aside from this similarity, a higher frequency of the incoming students score at the lower end of the test scores, while a higher frequency of the non-mobile students score at the higher end of the test scores. This is reflected in the performance level chart in Figure 4.24, where a higher percentage of the incoming students are at the Failing level than the non-mobile students, and vice versa for the remaining levels.

While a majority of the Cohort 1 students scored a 200 on the ELA portion of the MCAS, Cohort 2 students did not follow the same trend. About 7% of the incoming students received this score, but only about 1% of the non-mobile students received it. The majority of the scores in both non-mobile and incoming students were centered on a score of 218, and more evenly dispersed throughout the remaining values with a bell curve distribution. Without the large number of students with a score of 200, the validity of this comparison is increased.

Cohort 2: Mathematics

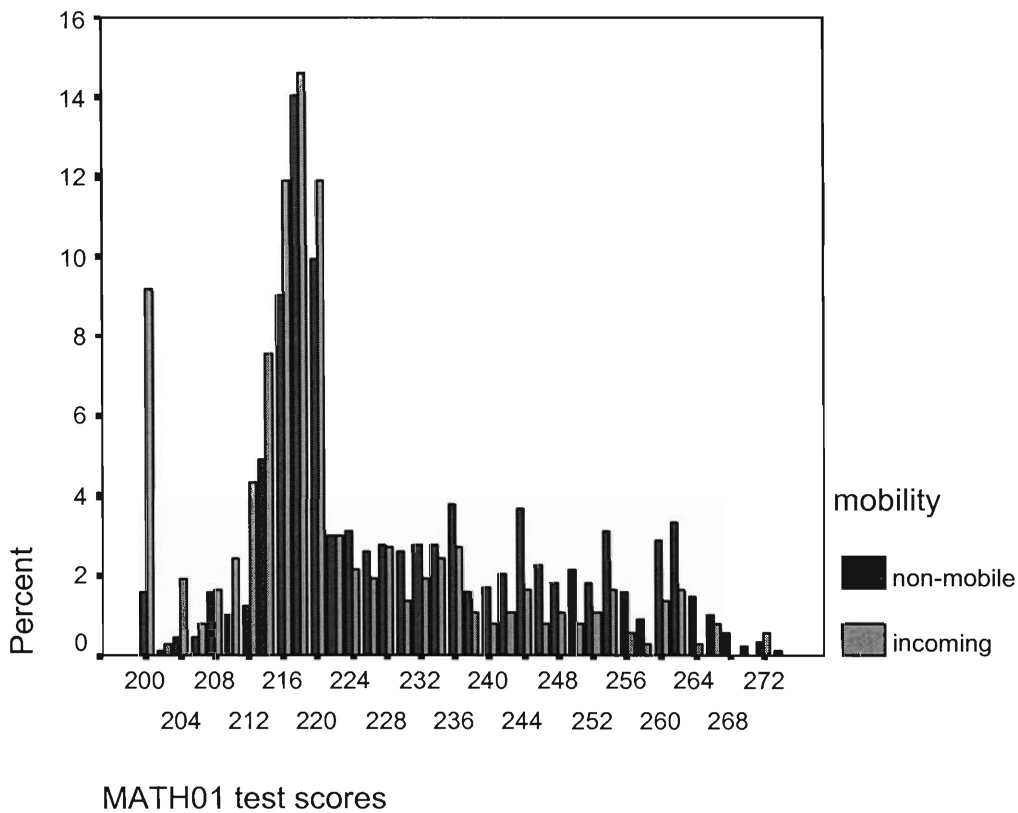

Figure 4.25: Cohort 2—10th grade Mathematics test score frequencies

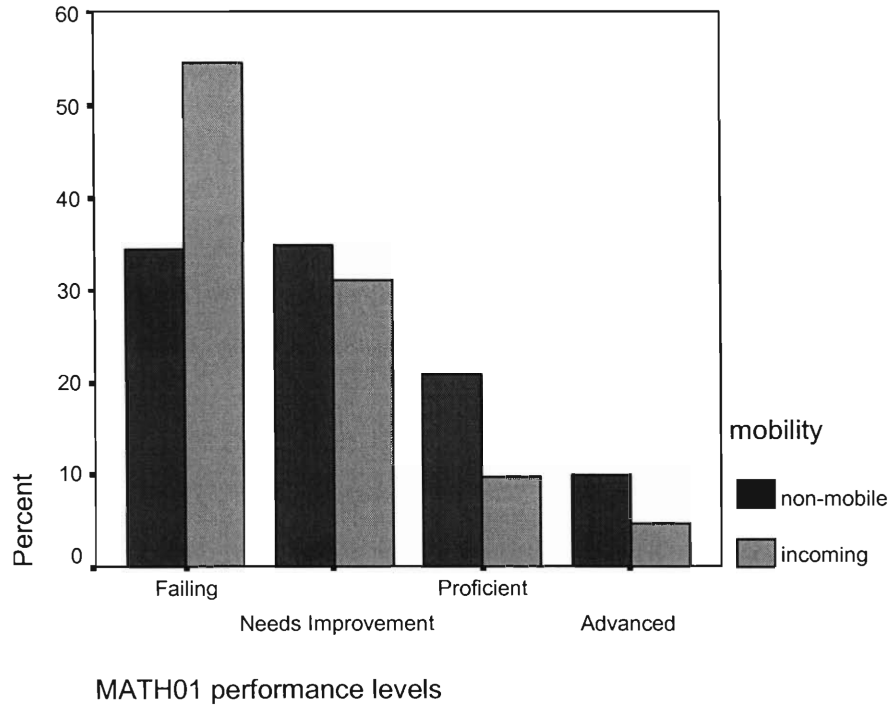

Figure 4.26: Cohort 2—10th grade Mathematics performance levels

Non-mobile and incoming students were centered fairly evenly on scores of 216 and 218 for the Mathematics portion of the MCAS, the same trend that was evident for the ELA portion of this cohort. As shown in the frequency plot in Figure 4.25, test scores for both non-mobile students tended to score more frequently on the higher end of the test scores, while incoming students tended to score more on the lower end. As shown in the performance level chart in Figure 4.26, about 55% of the incoming students were in the Failing level, while only about 34% of the non-mobile students performed at this level. Furthermore, a higher percentage of the non-mobile students scored in the Proficient and Advanced levels.

The students in this cohort of this year were not centered on the score of 200 in Mathematics. Only about 9% of the incoming students received this score, while the remaining scores were more evenly dispersed among the students in a bell curve distribution, much like the ELA results. A bell curve distribution indicates that the most frequently occurring score is centered on a particular value (in this case, a score of about 216 or 218), and the occurrence of the remaining scores reduce in frequency. Since there was not a high frequency of a score of 200, this cohort is more valid than Cohort 1, since it could be analyzed without further processing. This cohort reinforced the trend that incoming students tended to score lower on the MCAS than non-mobile students, with a mean difference of about 8 points.

We believe that the students' score distribution was more evenly distributed in this cohort because the test was implemented as a graduation requirement in this year. As a result there would be fewer students who simply refused to take the test, and therefore received a score of 200. Students in this year may have been more prepared for this test and determined to score higher, whereas in previous years students may have had less incentive to perform well on the test.

4.3 Prediction of 10th Grade MCAS Scores Without Mobility

We performed a linear regression test to correlate the 8th grade non-mobile scores to 10th grade non-mobile scores, in order to discover any possible trends. A relation was found between these two non-mobile groups of students, and described a formula. We then incorporated all of the students in the 8th grade—both mobile and non-mobile—to predict the potential mean score in 10th grade if there was no student mobility. SPSS was used to correlate as many variables in the 8th grade as possible to accurately predict the 10th grade score. Each variable—which included gender, race, free lunch eligibility, and 8th grade test scores for ELA and Mathematics—was inserted into SPSS to determine if the correlation coefficient R^2 would increase and if its significance level was low enough. A significance level of 0.05 (which indicates a 95% confidence level) was considered sufficient.

Cohort 1: English Language Arts

We found the variables of gender, ELA results in 8th grade, and Mathematics results in 8th grade to be valid predictors of the ELA mean score in 10th grade. The correlation value R was equal to 0.747, showing a high correlation between the variables. Significance values for each of the variables were very small (0.00018 and lower), indicating a high significance of the variable. The significance level of the constant term was high, at 0.575, indicating an expected error of the prediction. Further details about this regression are available in Appendix I.

When this regression formula was applied, we found the predicted ELA mean score in 10th grade would be 222.19, which was very close to the actual 10th grade mean score of 222.39. The 8th grade mean score in ELA for this cohort was 231.55. This predicted score shows that the ELA mean score would have decreased even if there were no student mobility factors involved. The strong correlation of this regression test indicates that there was a trend in this cohort for students to decrease in ELA scores when they retake the test in 10th grade. Reasons for this trend may be due to the difficulty of the 10th grade test, when compared to the 8th test.

Cohort 1: Mathematics

We found that gender was not an accurate variable to include in this regression, and only the variables of ELA and Mathematics scores in the 8^{th} grade were of valid significance levels. The correlation value R for this regression was 0.773, which indicated a very high correlation, and the significance values for the variables were 0.001 and less, which indicated a valid significance. Further details about this regression are available in Appendix I.

When this regression formula was applied we found that the Mathematics mean score would have been a 219.57 if there were no mobile students, which was very close to the actual 10^{th} grade mean score 219.84. The 8^{th} grade mean score in Mathematics for this cohort was 217.27. The regression indicates that the mean score would have increased only slightly if there were no mobility factors involved.

Cohort 2:

We found that a valid linear regression could not be formulated for Cohort 2. The highest correlation value R was only a 0.378, indicating a very low correlation between the two values. As a result, no predicted mean score was calculated. The details of the attempted linear regression are in Appendix I

We believe this low correlation to be due to the results of the 2001 MCAS, since the test was used as a graduation requirement in the administered year. As seen in the previous sections, the frequency of the test scores in 2001 (which were from students in Cohort 2 in the 10^{th} grade) displayed a very different distribution than the test scores in 1999 (which were from the students in Cohort 2 in the 8^{th} grade). The 1999 results were marked by high failure rates and a great deal of scores of 200, while the 2001 results had a bell curve distribution and lower failure rates. As a result of these two different distributions a correlation could not be found to form a regression formula.

This study would be more valid if the graduation requirement was not enacted in 2001, or if it was enacted in all previous years as well. Due to the effects of the requirement, which include higher test-taking efforts of the students and academic programs in the public schools, students who performed poorly in the 8^{th} grade in 1999 tended to achieve higher scores in the 10^{th} grade in 2001. Future linear regression tests, where both 8^{th} and 10^{th} grade tests are graduation requirements, will be more valid and successful.

4.4 Reasons for Student Mobility

Due to time limitations, we did not receive responses to the questionnaires we had distributed to principals of public schools in time to include in this report. We sent out the questionnaire via email to 9 different principals, inquiring why students had left their school, and asked them to print the form and return it to us by fax. Unfortunately this questionnaire was not compiled until near the end of our project, as the data required a great deal of reorganization. Hopefully, this questionnaire will still be completed and returned to the Central Administration Building after this project for their future analysis.

After sending the questionnaires, however, Dr. Mostue informed us that the SAGE database includes reasons why students left the school system. This information is readily available on the database, and could have been used for our analysis instead of compiling our questionnaire.

4.5 Analysis of Individual Schools in the Worcester Public Schools

Frequency plots of each school's test scores and performance levels are available in Appendix H. Cohort 1 continues to represent 8^{th} grade students in 1998 and 10^{th} grade students in 2000, while Cohort 2 continues to represent 8^{th} grade students in 1999 and 10^{th} graders in 2001.

4.6 Effect of Ethnicity on MCAS Scores

4.6.1 Analysis of 8th Grade Results

Cohort 1:

Test score summaries are tabulated below in Table 4.13 for each ethnic group:

Table 4.13: Cohort 1—8th grade test summaries based on ethnicity

ENG98 MATH98 * ETHNIC

ETHNIC		ELA98	MATH98
Native American	Mean	229.11	211.56
	# of students	9	9
	Std. Deviation	16.128	16.516
Asian	Mean	230.85	223.77
	# of students	113	113
	Std. Deviation	15.475	19.493
Hispanic	Mean	223.38	208.99
	# of students	381	382
	Std. Deviation	15.111	13.741
Black	Mean	227.17	208.42
	# of students	147	147
	Std. Deviation	14.488	12.913
White	Mean	236.10	221.72
	# of students	902	902
	Std. Deviation	14.584	19.640
Total	Mean	231.71	217.42
	# of students	1552	1553
	Std. Deviation	15.756	18.810

The breakdown of scores in Table 4.13 shows that the White students in this cohort tended to perform highest on the ELA portion of the test. Asian students performed the next highest, and Black and Hispanic students performed the lowest with mean scores of 227.17 and 223.38, respectively. Asian and White students also tended to score the highest on the Mathematics section of the test, while Black and Hispanic students performed the lowest on this section. Native American students did not serve as a valid representative comparison in the two subjects, as there were only 9 students in this ethnic group. The frequency plots of their performance levels are shown below in Figures 4.27 and 4.28:

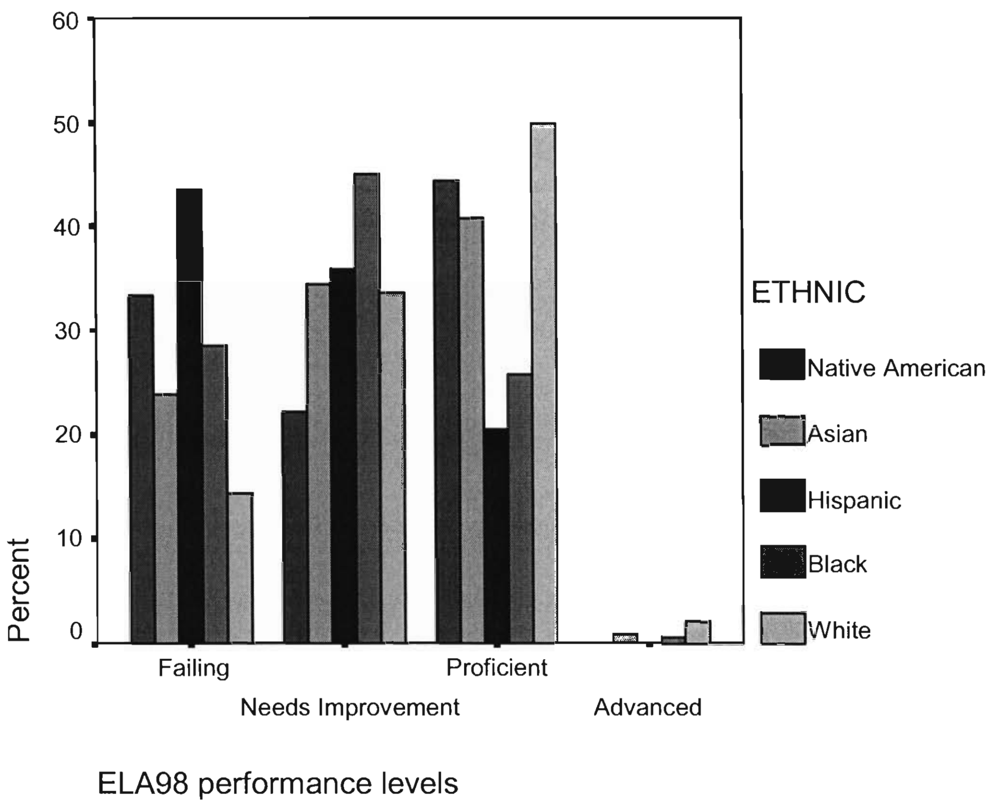

Figure 4.27: Cohort 1—8th grade performance levels in ELA based on ethnicity

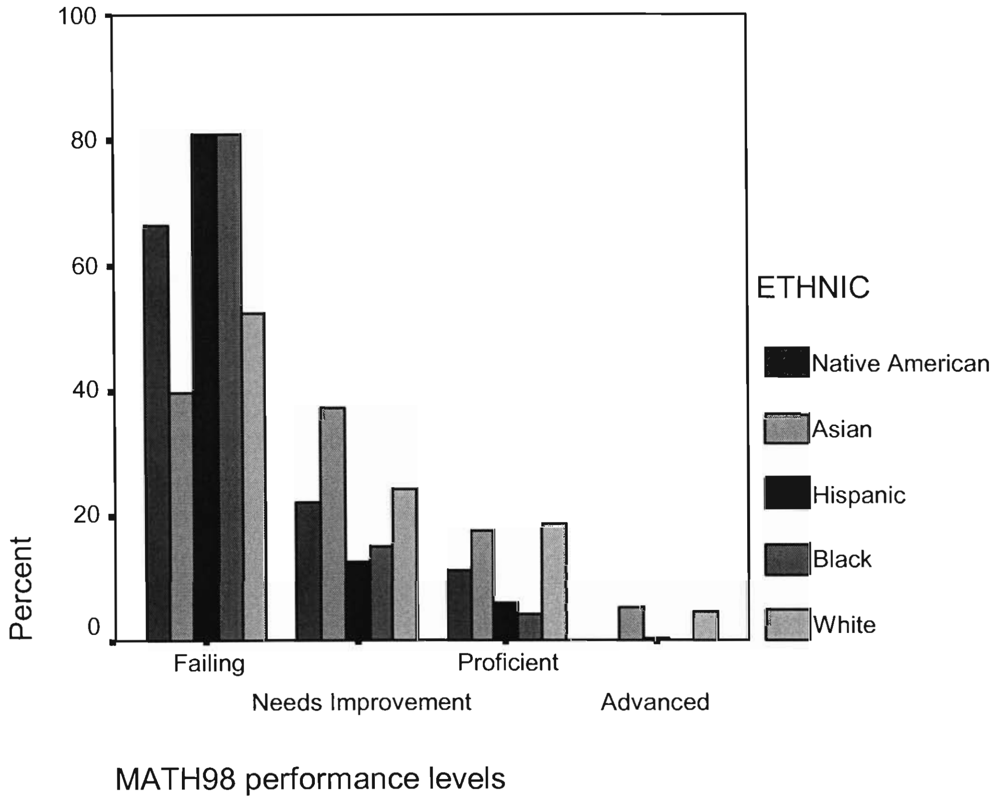

Figure 4.28: Cohort 1—8th grade performance levels in Mathematics based on ethnicity

After conducting this analysis it was clear that White and Asian students tended to score more evenly within the performance levels, with a fair distribution of students in each level, while Hispanic and Black students tended to score more frequently in the Failing performance level. We then conducted a test summary analysis to determine the performance levels of only the non-mobile students compared to the outgoing students, based on ethnicity, to further examine the effect of mobility study. This was analysis was performed to determine where the point difference was the greatest, to discover if the outgoing students of a particular ethnic group performed the poorest of the cohort. These student scores are tabulated below in Tables 4.14 and 4.15:

Table 4.14: Cohort 1—8th grade test summary of outgoing students, based on ethnicity

Report

ETHNIC		ELA98	MATH98
Native American	Mean	224.00	213.67
	N	6	6
	Std. Deviation	17.664	19.284
Asian	Mean	227.00	218.59
	N	44	44
	Std. Deviation	16.979	18.610
Hispanic	Mean	219.58	205.91
	N	236	237
	Std. Deviation	14.131	11.240
Black	Mean	224.34	206.40
	N	95	95
	Std. Deviation	14.670	10.749
White	Mean	234.87	220.04
	N	488	488
	Std. Deviation	15.338	19.609
Total	Mean	229.10	214.58
	N	869	870
	Std. Deviation	16.483	18.083

Table 4.15: Cohort 1—8th grade test summary of non-mobile students, based on ethnicity

Report

ETHNIC		ELA98	MATH98
Native American	Mean	239.33	207.33
	N	3	3
	Std. Deviation	5.033	11.015
Asian	Mean	233.30	227.07
	N	69	69
	Std. Deviation	14.016	19.453
Hispanic	Mean	229.54	214.03
	N	145	145
	Std. Deviation	14.657	15.852
Black	Mean	232.35	212.12
	N	52	52
	Std. Deviation	12.728	15.585
White	Mean	237.56	223.69
	N	414	414
	Std. Deviation	13.517	19.516
Total	Mean	235.04	221.03
	N	683	683
	Std. Deviation	14.106	19.112

When comparing Tables 4.14 and 4.15, which tabulate test summaries of the non-mobile and the outgoing students, it is evident that the outgoing students tend to score a few points lower than the non-mobile students' mean score. The point difference in White and Asian students are the lowest, at only a few points, while the point difference for the remaining ethnic groups is greatest, at 8 to 10 points. This shows that the Black and Hispanic outgoing students in this cohort tend to score the lowest on both portions of the MCAS, when compared to the remaining students in the cohort.

Cohort 2

Test score summaries of Cohort 2 are tabulated below in Table 4.16:

Table 4.16: Cohort 2—8th grade test score summary based on ethnicity

Report

ETHNIC		ELA99	MATH99
Native American	Mean	231.67	216.00
	N	6	6
	Std. Deviation	12.925	19.225
Asian	Mean	230.40	222.69
	N	120	122
	Std. Deviation	13.950	17.588
Hispanic	Mean	221.51	209.38
	N	419	426
	Std. Deviation	13.698	12.726
Black	Mean	228.27	214.12
	N	146	148
	Std. Deviation	13.458	14.280
White	Mean	234.29	222.39
	N	870	876
	Std. Deviation	14.545	18.390
Total	Mean	229.99	218.10
	N	1561	1578
	Std. Deviation	15.174	17.582

This cohort demonstrated the same trend as the previous cohort: White and Asian students tended to score highest on both sections of the test, while Black and Hispanic students tended to score lower. Black students scored relatively high, however, in the ELA portion of the test, only 2 points below the Asian mean score. Native American students were very few in number and did not serve as a representative comparison. Frequency plots of their test performance levels are below in Figures 4.29 and 4.30:

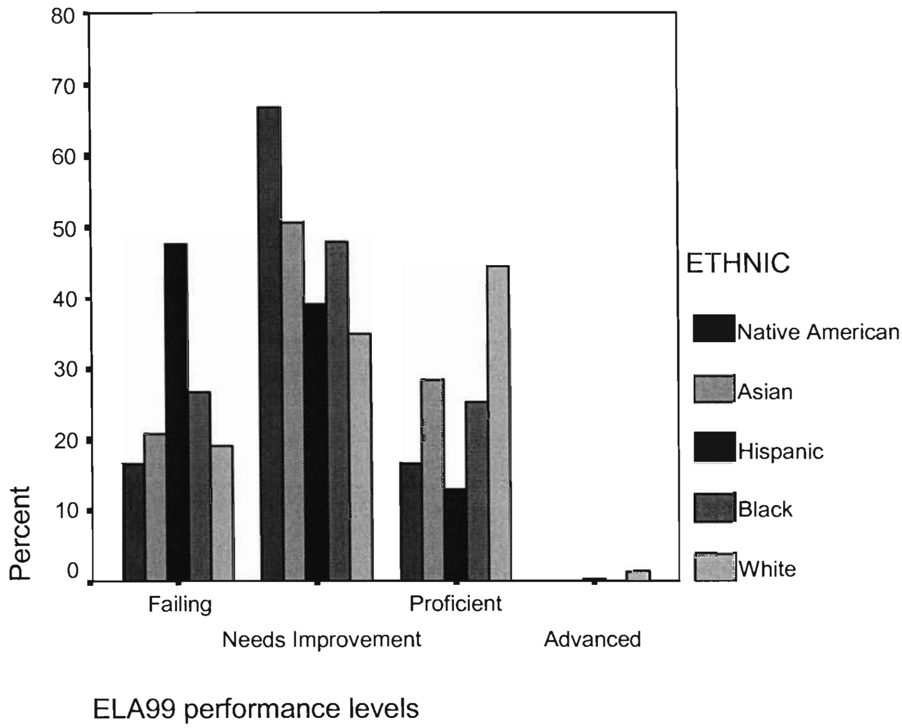

Figure 4.29: Cohort 2—8th grade performance levels in ELA section, based on ethnicity

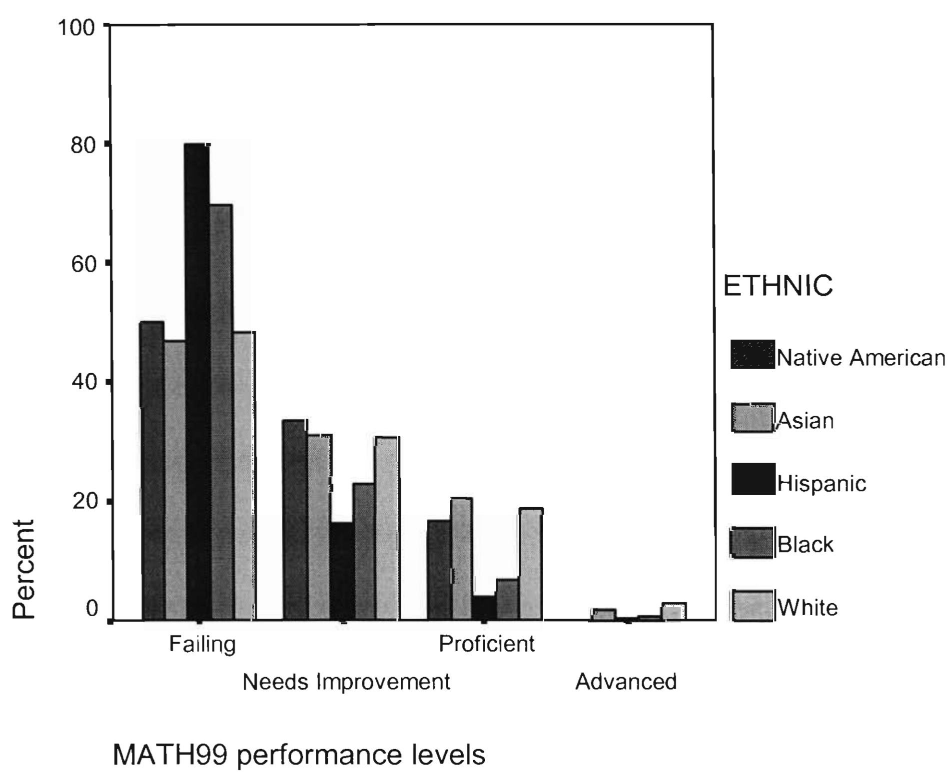

Figure 4.30: Cohort 2—8th grade performance levels in Mathematics, based on ethnicity

These plots show the continuing trend of higher frequencies of White and Asian students scoring in the higher performance levels than the Hispanic and Black students. A greater percentage of the White and Asian students are in the Needs Improvement and Proficient rankings than the Hispanic and Black students.

Students were then analyzed based on mobility as well. The non-mobile and outgoing student score summaries are tabulated below in Tables 4.17 and 4.18:

Table 4.17: Cohort 2—8th grade test summaries of outgoing students, based on ethnicity

Report

ETHNIC		ENG99	MATH99
Native American	Mean	225.00	211.50
	# of students	4	4
	Std. Deviation	6.831	13.503
Asian	Mean	223.89	217.53
	# of students	37	38
	Std. Deviation	15.613	16.554
Hispanic	Mean	218.61	207.76
	# of students	214	221
	Std. Deviation	13.538	11.555
Black	Mean	223.63	210.57
	# of students	65	67
	Std. Deviation	13.724	12.450
White	Mean	229.17	216.69
	# of students	346	351
	Std. Deviation	15.299	17.714
Total	Mean	224.92	213.21
	# of students	666	681
	Std. Deviation	15.300	15.909

Table 4.18: Cohort 2—8th grade test summaries of non-mobile students, based on ethnicity

Report

ETHNIC		ELA99	MATH99
Native American	Mean	245.00	225.00
	N	2	2
	Std. Deviation	12.728	32.527
Asian	Mean	233.30	225.02
	N	83	84
	Std. Deviation	12.155	17.638
Hispanic	Mean	224.55	211.11
	N	205	205
	Std. Deviation	13.229	13.696
Black	Mean	232.00	217.06
	N	81	81
	Std. Deviation	12.083	15.083
White	Mean	237.67	226.20
	N	524	525
	Std. Deviation	12.973	17.857
Total	Mean	233.76	221.81
	N	895	897
	Std. Deviation	13.936	17.888

The point difference between Tables 4.17 and 4.18—that is, the mean scores of the outgoing students versus the mean scores of the non-mobile students—is much higher than the point difference seen in Cohort 1. The Hispanic students demonstrated the least point difference of only 4 to 6 points. The largest point difference was now evident in the remaining ethnic groups, contrary to the results from Cohort 1, with point differences of 7 to 10 points in each subject.

This trend is opposite that of the previous cohort, which demonstrated that White students had a smaller point difference than the remaining ethnic groups. When comparing the mean score of the entire cohort, inclusive of all the ethnic groups, it can be seen that the point difference between the overall mean score and outgoing students' mean score was greater in the second cohort (8th grade students in 1999) than in the first cohort (8th grade students in 1998). This caused the individual ethnic groups to have a larger point difference as well, between the mean score of the entire ethnic group and of only the outgoing students. Since the overall point difference of Cohort 1 was much smaller, the two cohorts are difficult to compare in this manner.

This trend causes the prior ethnic study to be inconclusive, as the two cohorts have opposing trends, and therefore a unanimous conclusion cannot be made.

4.6.2 Analysis of 10th grade results

Cohort 1:

The results of the Cohort 1 10th grade test are summarized below Table 4.19, based on ethnicity:

Table 4.19: Cohort 1—10th grade test summaries, based on ethnicity

Report

ETHNIC		ELA00	MATH00
Native American	Mean	218.00	212.00
	N	4	4
	Std. Deviation	17.739	10.954
Asian	Mean	222.82	226.33
	N	85	86
	Std. Deviation	18.686	23.170
Hispanic	Mean	215.90	210.57
	N	180	190
	Std. Deviation	16.888	15.012
Black	Mean	217.87	212.18
	N	77	79
	Std. Deviation	17.452	17.597
White	Mean	223.02	220.99
	N	495	497
	Std. Deviation	19.950	22.529
Total	Mean	220.98	218.36
	N	841	856
	Std. Deviation	19.175	21.305

The ethnicity trend is repeated, as shown in Table 4.19 above, where White and Asian students tend to score higher than Black and Hispanic students. The point difference between the Asian and White students' mean score versus the Black and Hispanic students' mean score is about 7 to 8 points in each subject. Their frequency plots are shown below in Figures 4.31 and 4.32, detailing the distribution of their scores:

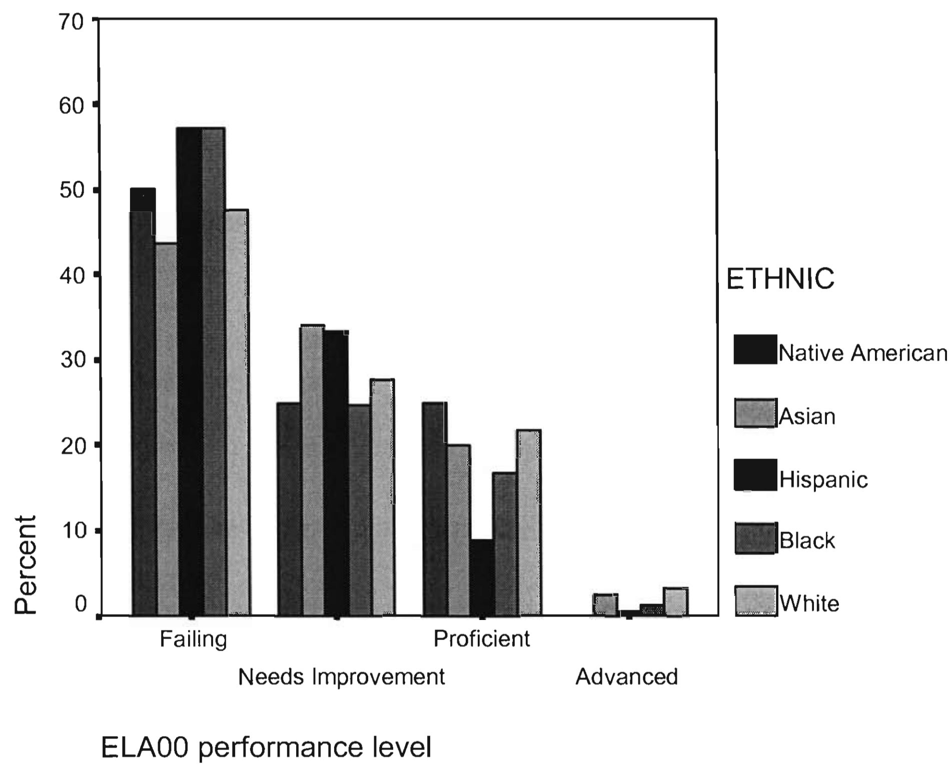

Figure 4.31: Cohort 1—10th grade performance levels in ELA, based on ethnicity

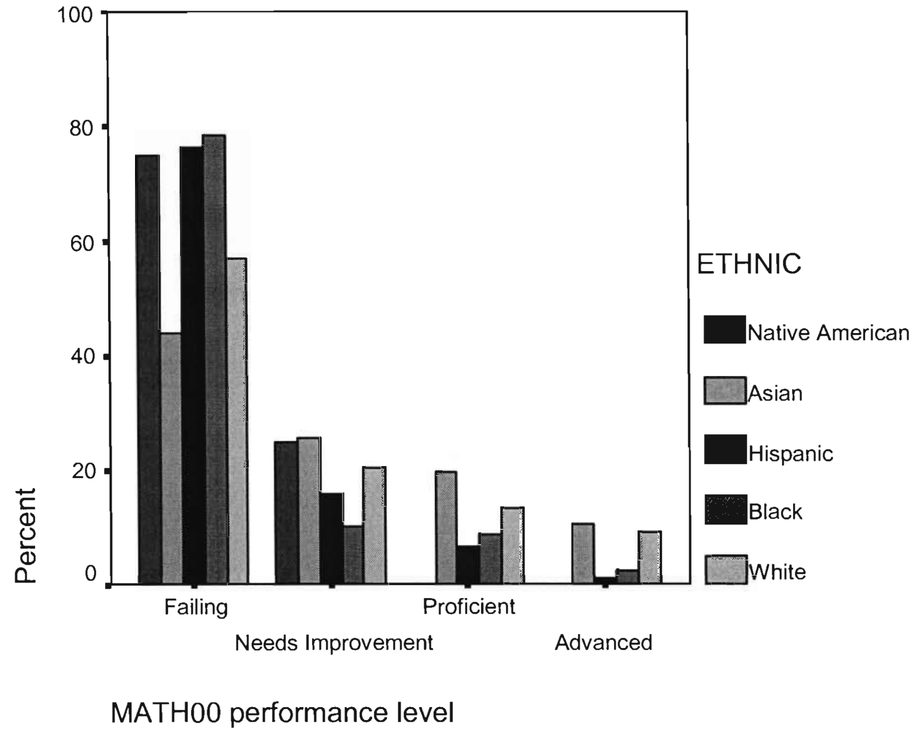

Figure 4.32: Cohort 1—10th grade performance levels in Mathematics, based on ethnicity

The distribution of scores is very similar for each ethnic group at each performance level. Hispanic and Black students tend to score more frequently in the Failing performance level, but the remaining performance levels are more evenly dispersed among the ethnic groups. The incoming and non-mobile students were then isolated and analyzed separately based on ethnicity. Their test score summaries are tabulated below in Tables 4.20 and 4.21:

Table 4.20: Cohort 1—10th grade test summary of incoming students, based on ethnicity

Report

ETHNIC		ELA00	MATH00
Native American	Mean	200.00	214.00
	# of students	1	1
	Std. Deviation	.	.
Asian	Mean	209.78	219.44
	# of students	18	18
	Std. Deviation	14.207	21.560
Hispanic	Mean	210.35	205.45
	# of students	40	47
	Std. Deviation	14.780	10.523
Black	Mean	216.62	208.21
	# of students	26	28
	Std. Deviation	17.958	13.011
White	Mean	219.02	217.08
	# of students	90	91
	Std. Deviation	20.955	23.164
Total	Mean	215.62	212.99
	# of students	175	185
	Std. Deviation	18.896	19.704

Table 4.21: Cohort 1—10th grade summary of non-mobile students, based on ethnicity

Report

ETHNIC		ELA00	MATH00
Native American	Mean	224.00	211.33
	N	3	3
	Std. Deviation	16.000	13.317
Asian	Mean	226.33	228.15
	N	67	68
	Std. Deviation	18.263	23.389
Hispanic	Mean	217.49	212.25
	N	140	143
	Std. Deviation	17.163	15.892
Black	Mean	218.51	214.35
	N	51	51
	Std. Deviation	17.334	19.443
White	Mean	223.91	221.87
	N	405	406
	Std. Deviation	19.636	22.320
Total	Mean	222.39	219.84
	N	666	671
	Std. Deviation	19.012	21.506

The results from Tables 4.20 and 4.21 show that the Asian students had the highest point difference of more than 9 points for each subject. However, there were only 18 incoming Asian students, which may not have been enough students to be a valid representation of the ethnic group. Hispanic students were the next highest in point difference, with incoming students tending to score about 7 points lower than non-mobile students. White and Black students had a point difference of only about 4 points.

Cohort 2:

The results of Cohort 2 10th grade test summaries are tabulated below in Table 4.22:

Table 4.22: Cohort 2—10th grade summaries of test scores based on ethnicity

Report

ETHNIC		ELA01	MATH01
Native American	Mean	228.00	237.50
	# of students	4	4
	Std. Deviation	17.049	22.650
Asian	Mean	229.50	233.85
	# of students	105	109
	Std. Deviation	15.286	17.070
Hispanic	Mean	221.72	219.21
	# of students	275	299
	Std. Deviation	13.026	10.772
Black	Mean	225.78	223.21
	# of students	163	163
	Std. Deviation	13.789	14.292
White	Mean	234.01	232.53
	# of students	690	692
	Std. Deviation	16.446	17.888
Total	Mean	229.79	228.32
	# of students	1237	1267
	Std. Deviation	16.132	17.021

The ethnicity trend continues in this cohort, where White and Asian students are tending to perform highest on the test. Black students fall below by several points (about 9 points in Mathematics and 4 points in ELA), and Hispanic students performed the lowest (about 4 points below Black students in each). Their performance level frequency plots are below as Figures 4.33 and 4.34:

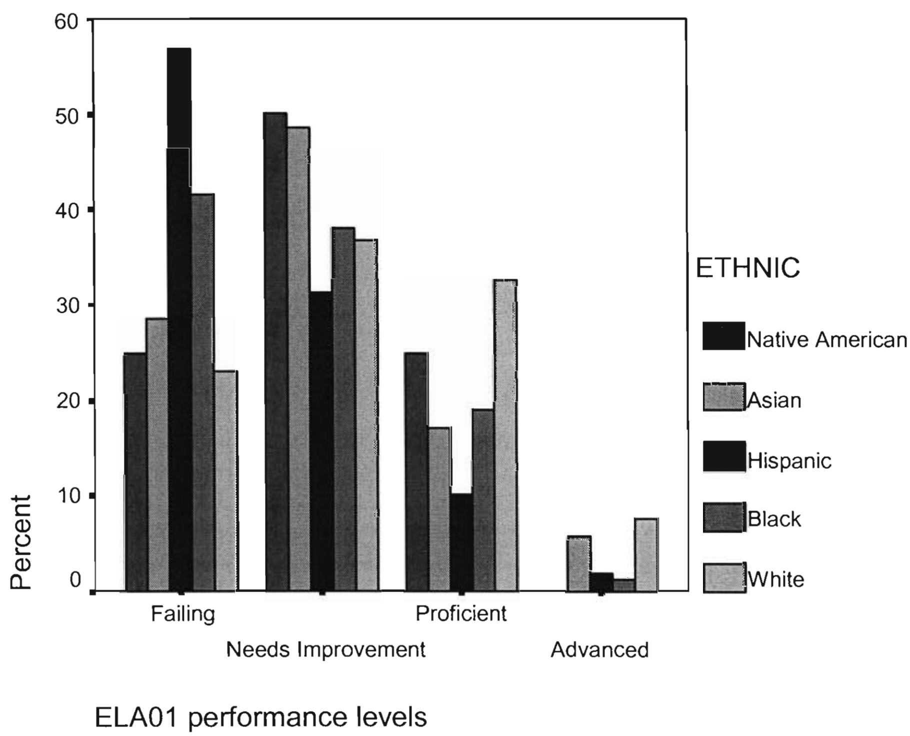

Figure 4.33: Cohort 2—10th grade performance levels in ELA, based on ethnicity

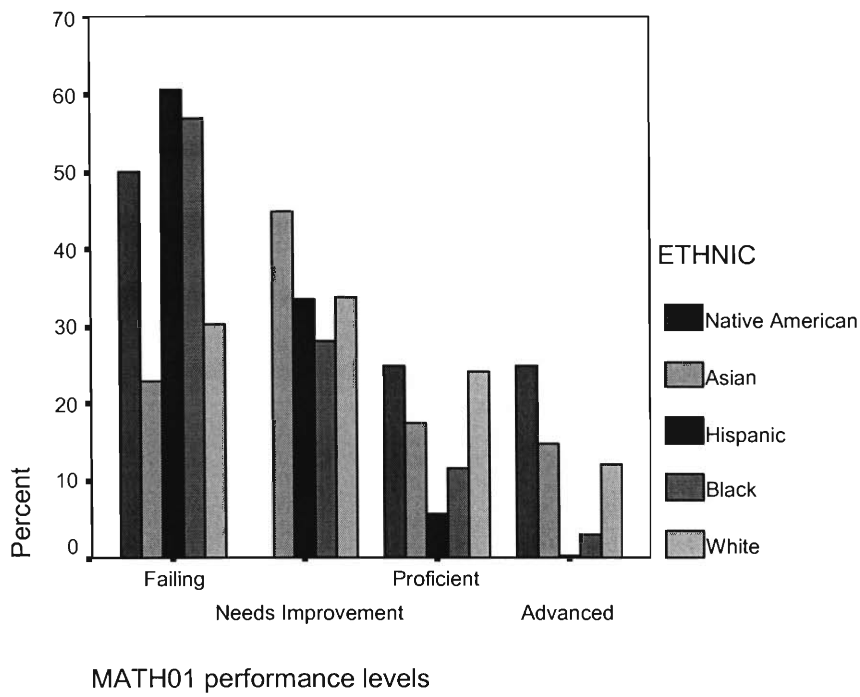

Figure 4.34: Cohort 2—10th grade performance levels in Mathematics, based on ethnicity

This cohort shows a clearer trend of Hispanic and Black students scoring within the Failing level, while White and Asian students tended to score within the Needs Improvement and Proficient levels. The incoming and non-mobile students were then isolated and compared against the entire cohort. Their scores are summarized below in Tables 4.23 and 4.24:

Table 4.23: Cohort 2—10th grade test summaries of incoming students

Report

ETHNIC		ELA01	MATH01
Native American	Mean	217.00	236.00
	# of students	2	2
	Std. Deviation	7.071	25.456
Asian	Mean	222.50	233.22
	# of students	20	23
	Std. Deviation	11.311	15.524
Hispanic	Mean	219.16	215.96
	# of students	76	99
	Std. Deviation	13.980	9.298
Black	Mean	221.53	219.41
	# of students	81	81
	Std. Deviation	12.603	12.208
White	Mean	227.61	225.68
	# of students	165	165
	Std. Deviation	16.382	18.004
Total	Mean	223.95	222.23
	# of students	344	370
	Std. Deviation	15.122	15.545

Table 4.24: Cohort 2—10th grade test summaries of non-mobile students

Report

ETHNIC		ELA01	MATH01
Native American	Mean	239.00	239.00
	N	2	2
	Std. Deviation	18.385	29.698
Asian	Mean	231.15	234.02
	N	85	86
	Std. Deviation	15.682	17.542
Hispanic	Mean	222.70	220.82
	N	199	200
	Std. Deviation	12.541	11.106
Black	Mean	229.98	226.98
	N	82	82
	Std. Deviation	13.693	15.249
White	Mean	236.02	234.67
	N	525	527
	Std. Deviation	15.959	17.321
Total	Mean	232.04	230.82
	N	893	897
	Std. Deviation	15.952	16.978

When comparing the results in Table 4.23 to Table 4.24, it can be seen that the point difference between the mean score of the incoming students to non-mobile students is largest in the White students, at about 9 points difference. The Black students differ about 8 points in this comparison, while Hispanic students differ about 4 points. These trends are contrary to some previous trends, where Black and Hispanic mobile students scored much lower than non-mobile students of their respective ethnic group. The point difference between mobile and non-mobile White students also tended to remain lower in previous trends. Due to the small number of incoming students, however, the validity of this comparison is weakened, as these few students may not serve as a valid representation of the ethnic group.

Summary of Ethnicity Effects

This study showed that Hispanic and Black students tend to score lower on both portions of the test by several points, while White and Asian students tend to score higher. The ethnic mobility study was done to further analyze the test score distribution based on ethnicity, to determine if the mobile students of a particular ethnic background suppressed the overall average the most. This study was inconclusive, as in some years the Hispanic and Black students had the highest point difference, while in other years the White and Asian students had this difference. The trends of this study were variable and a uniform trend could not be found.

4.7 MCAS Score Breakdown by Gender

4.7.1 Grade 8 Analysis

Cohort 1:

Mean scores for the Cohort 1 8th grade results are tabulated below in Table 4.25:

Table 4.25: Cohort 1—8th grade results based on gender

GENDER		ELA98	MATH98
Female	Mean	234.60	216.60
	# of students	730	731
	Std. Deviation	15.024	18.222
Male	Mean	229.50	218.43
	# of students	803	803
	Std. Deviation	15.756	19.295
Total	Mean	231.71	217.42
	# of students	1552	1553
	Std. Deviation	15.756	18.810

The female students in this cohort tended to score higher on the ELA portion of the test than the male students, by about 5 points. The male students tended to score higher on the Mathematics portion by about 2 points, a minor point difference.

Cohort 2:

Table 4.26: Cohort 2—8th grade test summaries based on gender

GENDER		ELA99	MATH99
Female	Mean	231.95	217.96
	N	779	780
	Std. Deviation	14.765	17.034
Male	Mean	228.06	218.36
	N	778	786
	Std. Deviation	15.344	18.181
	Mean	222.50	210.00
	N	4	12
	Std. Deviation	13.404	10.090
Total	Mean	229.99	218.10
	N	1561	1578
	Std. Deviation	15.174	17.582

The trend is repeated with the second cohort, where female students tend to score higher on the ELA portion of the test than the male students, by almost 4 points. The male and female students scored almost identically on the Mathematics section.

4.7.2 Grade 10 Analysis

Cohort 1:

Table 4.27: Cohort 1—10th grade test results, based on gender

GENDER		ELA00	MATH00
Female	Mean	224.74	218.37
	# of students	413	421
	Std. Deviation	19.680	21.227
Male	Mean	217.26	218.31
	# of students	425	431
	Std. Deviation	17.907	21.334
Total	Mean	220.98	218.36
	# of students	841	856
	Std. Deviation	19.175	21.305

As was shown for the 8th grade test scores, female students in the 10th grade tended to score higher on the ELA portion than the male students, by about 7 points in this cohort. The Mathematics portion of the test was scored evenly between the two genders.

Cohort 2:

Table 4.28: Cohort 2—10th grade test summaries based on gender

GENDER		ELA01	MATH01
Female	Mean	231.70	228.19
	# of students	634	647
	Std. Deviation	16.256	16.416
Male	Mean	227.80	228.45
	# of students	601	618
	Std. Deviation	15.766	17.648
Total	Mean	229.79	228.32
	# of students	1237	1267
	Std. Deviation	16.132	17.021

Cohort 2 enforces the trend further: female students outperformed the male students in ELA by about 4 points, while they scored evenly in the Mathematics section.

This analysis showed that female students tended to score higher on the ELA portion of the test than the male students. The point difference between their mean scores ranged from 4 to 7 points. In the Mathematics section, however, the two genders scored very similarly and the point difference was no more than 2 points.

4.8 Low-income Effects on MCAS Scores

An analysis was completed to determine if a trend existed between students who received free lunch and students who did not. Free lunch served as an indication of low income, which was the objective of this study. However, Dr. Mostue informed us that some students who are eligible for free or reduced lunch—the indication of low income—simply refused to accept it. The data we received measured only if the student accepted free or reduced lunch, but not if they were eligible. As a result, many students who could have received free or reduced lunch did not apply for it, and were assumed to be full-paying students in our data. Therefore, free lunch was not a fully valid indicator of low income.

Frank Irwin, the Database Manager for the SAGE group, helped inform us of the validity of the free lunch variable. He explained that students in the 10th grade tended to refuse to apply for free or reduced lunch, in fear of ridicule or judgment from fellow students. He analyzed students in grades 1 through 6 and found that 60% of the students apply for free or reduced lunch, while only 49% of students apply in grades 7 through 12. Obviously not all of the students' families have suddenly increased in income, but the students simply refused to apply for free or reduced lunch in these years. This affects the validity of using free lunch as an indication of low income, as fewer students apply as they progress in school. We were limited by this variable, and our analysis would have been more accurate if we had the free lunch eligibility information as well.

4.8.1 Grade 8 Analysis

Cohort 1: 1998 8th grade students

Table 4.29: Cohort 1 free lunch analysis

FREELUNCH		ELA98	MATH98
Paid lunch	Mean	234.78	220.46
	# of students	1100	1101
	Std. Deviation	15.042	19.481
Free/reduced lunch	Mean	224.24	210.00
	# of students	452	452
	Std. Deviation	14.949	14.633
Total	Mean	231.71	217.42
	# of students	1552	1553
	Std. Deviation	15.756	18.810

Clearly the students who received free or reduced lunch tended to score about 10 points lower in each subject than the students who paid for lunch in this cohort.

Cohort 2: 1999 8th grade students

Table 4.30: Cohort 2 free lunch analysis

FREELUNC		ELA99	MATH99
Paid lunch	Mean	234.17	222.50
	# of students	860	872
	Std. Deviation	14.797	18.616
Free/reduced lunch	Mean	224.86	212.66
	# of students	701	706
	Std. Deviation	14.019	14.484
Total	Mean	229.99	218.10
	# of students	1561	1578
	Std. Deviation	15.174	17.582

The students in this cohort follow a very similar trend, with a point difference of about 10 points as well in each subject. The validity of the free lunch variable is questionable, however, considering the high number of free lunch applicants in this cohort (44% of all students applied), compared to the lower number in the previous cohort (only 29%). For an unknown reason fewer students applied in Cohort 1, when it can be expected that the percentage in both cohorts would be similar.

4.8.2 Grade 10 Analysis

Cohort 1: 2000 10th grade students

Table 4.31: Cohort 1 free lunch analysis

FREELUNC		ELA00	MATH00
Paid lunch	Mean	223.31	220.99
	# of students	603	609
	Std. Deviation	19.544	22.270
Free/reduced lunch	Mean	215.07	211.87
	# of students	238	247
	Std. Deviation	16.852	17.104
Total	Mean	220.98	218.36
	# of students	841	856
	Std. Deviation	19.175	21.305

The mean score difference is still evident in the 10th grade in this cohort, where students who paid for lunch scored about 8 points higher in ELA and 9 points higher in Mathematics than the free lunch students.

Cohort 2: 2001 10th grade students

Table 4.32: Cohort 2 free lunch analysis

FREELUNC		ELA01	MATH01
Paid lunch	Mean	232.76	230.66
	# of students	780	788
	Std. Deviation	16.865	17.998
Free/reduced lunch	Mean	224.73	224.46
	# of students	457	479
	Std. Deviation	13.369	14.494
Total	Mean	229.79	228.32
	# of students	1237	1267
	Std. Deviation	16.132	17.021

The free lunch trend still exists in this cohort, with paid lunch students tending to score about 8 points higher in ELA and 6 points higher in the Mathematics section.

5. Conclusions

Our findings conclude that mobility does in fact have an effect on the average MCAS scores in the 8th and 10th grade. Students who are mobile consistently tend to score several points lower than non-mobile students on the ELA and Mathematics portions of the test. With this information at hand, we conclude that analysis and comparison of all student scores within a particular year is invalid, as a vast majority of the students are either departing or entering the school system, suppressing the average score. Student mobility must be accounted for when MCAS averages are compared, and it cannot be assumed that the same students partake in the test each year.

Furthermore, school performance measurement should not be examined primarily by the overall MCAS average score, but should take student mobility into account.

From our linear regression test we found for Cohort 1, the class of 2002, that the predicted 10th grade mean score, which was characterized by zero mobility, was close in value to the actual 10th grade mean score. This indicated that students in this cohort tended to decline in MCAS scores in the English Language Arts portion of the test, while improve only slightly in the Mathematics portion. This decline, we believe, is due to the difficulty of the 10th grade MCAS in comparison to the 8th grade version of the test.

A predicted score could not be found for the second cohort, who took the 10th grade MCAS in 2001. This was due to the enormous change in MCAS performance, due to its implementation as a graduation requirement. Scores in this year were characterized by larger frequencies in the higher performance levels, as well as fewer students with a 200 score. In future years this regression study will be more conclusive. Our study involved only one MCAS test as a graduation requirement; as a result the scores from this test were much higher and dispersed. Students had a higher incentive when participating in this test, as their performance indicates. On the contrary, the past MCAS results which we analyzed may be reasoned to be a result of students who were apathetic towards the test. As future MCAS tests are used as graduation requirements, their results may be used with greater validity, as students have a greater incentive to perform well.

We concluded that Hispanic and Black students tended to perform several points lower than White and Asian students. The mobility study, which attempted to discover the largest point difference between non-mobile and mobile students within an ethnic group, was inconclusive. This study attempted to discover any trend of a particular ethnic group's mobile students performing much lower than its non-mobile students.

Low income students, measured by their application into free/reduced lunch programs, tended to score several points lower than the remainder of the students. We found that free lunch was not a completely accurate measurement of low income, as some students in low income families simply did not apply. Nevertheless, we found that these students performed lower on the MCAS test. Reasons for this trend may be due to substandard education in poor areas.

Limitations for our project included time restraints, which disallowed our further analyses and interpretations of some data. Reasons for student mobility, for example, were unable to be found as the principal questionnaire was not completed in time. Our project also suffered several major redirections, and as a result data and project goals were constantly changed. The nature of this project also limited the efficiency of our work, as only two computers were available and the analysis consisted mainly of statistical processes. Only one person was able to perform the statistical analysis while the remainder of the group conducted other work, as it would be inefficient for all members of the group to simultaneously perform the same work.

Further limitations included the disorganization of the data, which required extensive processing and filtering. We succeeded in matching up a vast majority of the data (about 99%), but some variables were still missing from the list including ethnicity and free lunch. We had little prior knowledge of SPSS or Access, and much time was spent getting acquainted with the software.

The use of free lunch as a measurement for low income was also a limitation. For future studies, usage of free lunch eligibility would be a more valid measurement, if available.

Recommendations for future studies include discovering reasons why students leave WPS. We attempted to collect this information but failed to send the questionnaires in time. Future studies could analyze this data, or create a new questionnaire to be analyzed. Also, further investigation into low income in relation to MCAS scores would be beneficial as well. We were only able to recognize the trend of low income students who score lower on the MCAS, but unable to identify any reasons.

Furthermore, future studies of the MCAS may be more valid than the past years' tests that we studied. Future MCAS participants have a greater incentive to excel in the test—graduation from high school—and as a result the test scores will be more evenly distributed.

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Appendix A

Liaison and Sponsor Organization

Background

Appendix A

Our sponsoring organization is the Worcester Public Schools (WPS) system, specifically the office of Testing and Assessment, directed by our project liaison Patricia Mostue.

The WPS, comprised of School Committee members, school personnel, families, elected City, State and Federal officials, and community members, have become known as a successful urban school system. They have they earned the reputation of providing quality education in a safe and caring environment, through the implementation of their four strategic goals. These goals include ensuring that all students achieve high academic standards, enhancing the quality of all personnel, assuring that all schools are supported wisely through various budget programs, and creating a healthy and supportive learning community.

The WPS strives for high academic standards in several ways, including challenging curricula, assessment systems, implementation of school improvement plans, and technology expansion. The curricula are a result of the Massachusetts Common Core of Learning and the Curriculum Frameworks of the state Education Reform Law of 1993. These curricula are supported by the WPS through literacy and reading programs throughout the city. Among the various assessment systems utilized by the WPS, standardized tests are implemented including the Massachusetts Comprehensive Assessment System (MCAS), and the Progress Toward Standards (PTS) test. The WPS system also provides many programs that ensure continuous student growth and progress, such as Advanced Placement courses and tutoring programs. To address improved student achievement and teacher effectiveness, Worcester Education Partnership has developed school improvement plans such as Advancing Via Individual Determination (AVID) and Turning Points. And lastly, WPS' effort to maintain and expand technology has resulted in an increase in the number of teachers trained to teach technology.

The WPS seeks to enhance the quality of all personnel, by creating a supportive environment for educators and providing an ethnically diverse teaching community. They maintain a supportive environment to encourage new ideas and innovations through teacher awards and recognition incentives, and increasing teacher mentoring programs. Furthermore, the WPS endeavors for an increased minority staff to join the educational community.

Assuring a wise expenditure of the school budget is the third goal of the WPS, through various budget culmination programs. They develop procedures for school and program budgeting, fund quality learning environments, and nurture safety programs. School and program budgeting procedures in WPS include reporting on annual expenditures, and requesting grants for supporting school improvement. They are responsible for creating quality learning environments by renovating and repairing school buildings, constructing new schools, and adapting energy conservation programs. Lastly, safety programs such as school crisis response plans and staff safety training are organized and maintained by the WPS.

The final goal of the WPS is to create a healthy and supportive community to encourage child development. They seek to increase parental involvement and participation in the overall growth of their children, through programs such as Head Start and Parent-Child-Home. This community is also shared with businesses and colleges in the surrounding area, by encouraging college student tutoring for the MCAS, as well as through the Career Passport process, which uses various school performance factors to affect employment hiring or college admissions. Furthermore, the WPS fosters increased cable television programming to inform parents and students about various community events.

Our project liaison, Patricia Mostue, is responsible for developing a system for monitoring school performance in WPS. She identifies problems within the WPS so that remedial actions can be taken, as well as diagnosing the strengths and weaknesses in students' mastery of the Frameworks curriculum. She offers new ideas to administration that affect policy and practice of WPS, based on the results of research and statistical analysis that she conducts. Furthermore, it is her duty to motivate administrators and teachers to improve student performance and achievements.

Other major related tasks that Ms. Mostue is responsible for include efficient assessment and evaluation as well as data processing and report writing. Using formative and summative evaluation techniques, she designs and develops citywide programs and evaluation models to meet and assess the requirements of statewide frameworks. She is also responsible for the interpretation of test results, particularly the MCAS, as well as the collection of other tests and test materials. Using statistical software such as SAS Ms. Mostue performs longitudinal studies of test results and various other student assessments. Finally, she writes reports based on her findings for the Superintendent, Deputy Superintendent, Quadrant Managers, and School Committee members.

Appendix B

Performance Level Definitions & Content Specific Performance

Level Definitions

the MCAS
publications
test related
results related
other resources
resources & links

Massachusetts Comprehensive Assessment System

Performance Level Definitions

Student results on the MCAS tests are reported according to four performance levels: *Advanced, Proficient, Needs Improvement* and *Failing*. This document includes both general and subject-specific descriptions of each of the levels. The general descriptions apply across subject areas and grade levels. Subject-specific performance level descriptions are provided for English Language Arts, Mathematics, and Science and Technology.

The performance level descriptions were used as a basis for determining the minimum score for each of the performance levels on each of the MCAS tests. The descriptions are meant to help teachers, students, parents and others understand the meaning of the MCAS results.

General Performance Level Definitions

ADVANCED

- Students at this level demonstrate a comprehensive and in-depth understanding of rigorous subject matter, and provide sophisticated solutions to complex problems.

PROFICIENT

- Students at this level demonstrate a solid understanding of challenging subject matter and solve a wide variety of problems.

NEEDS IMPROVEMENT

- Students at this level demonstrate a partial understanding of subject matter and solve some simple problems.

FAILING

- Students at this level demonstrate a minimal understanding of subject matter and do not solve simple problems.

Content-Specific Performance Level Definitions

English Language Arts

Student results on the MCAS tests are reported according to four performance levels: *Failing, Needs Improvement, Proficient,* and *Advanced*. The selected descriptors below illustrate the kinds of knowledge and skills students demonstrate on MCAS at each level. Knowledge and skills are cumulative at each level. No descriptors are provided for the *Failing* performance level because student work at this level, by definition, does not meet the criteria of the *Needs Improvement* level.

English Language Arts Curriculum Framework Core Concept: The goal of an English language arts curriculum is to teach learners how to reason and use language purposefully as they comprehend, construct, and convey meaning.

	Needs Improvement On MCAS, a student at this level:	Proficient On MCAS, a student at this level:	Advanced On MCAS, a student at this level:
Language/ Vocabulary	• demonstrates a modest reading	• demonstrates a solid reading	• demonstrates a comprehensi

	vocabulary and partial understanding of word parts and word relationships (e.g., prefixes, roots, suffixes, synonyms, antonyms)	vocabulary and general understanding of word parts and word relationships (e.g., prefixes, roots, suffixes, synonyms, antonyms)	ve reading vocabulary and in-depth understanding of word parts and word relationships (e.g., prefixes, roots, suffixes, synonyms, antonyms)
Comprehension	• demonstrates an understanding of concrete ideas, but only partial understanding of abstract or implied ideas, in grade-appropriate texts • connects some ideas within texts	• demonstrates an understanding of many concrete ideas, and most abstract and implied ideas, in grade-appropriate texts • connects ideas within texts and provides supporting evidence	• demonstrates an in-depth understanding of concrete and abstract ideas and complex meanings in grade-appropriate texts • connects complex ideas within texts and provides well-reasoned and well-supported arguments
Text Elements and Techniques	• shows partial understanding of how structure and genre enhance the author's purpose or theme • identifies obvious examples of some techniques authors use	• shows clear understanding of structure and elements of genre and how they support the author's purpose or theme • identifies more subtle examples of techniques	• critically evaluates how structure and elements of genre support the author's purpose or theme • identifies and critically evaluates techniques authors use

	(e.g., repetition, exaggeration, and figurative language)	authors use in a variety of texts (e.g., repetition, exaggeration, and figurative language) as grade-appropriate	in a wide variety of texts (e.g., repetition, exaggeration, and figurative language)
Composition	• writes partially organized compositions with modestly developed ideas, some supporting detail, and some demonstration of focus • uses simplistic language and sentence structure	• writes well-organized compositions with logically developed ideas, adequate detail, and clear focus • engages reader's interest through use of a variety of language choices and sentence structures	• writes well-organized, richly developed compositions with ideas that are clearly expressed and supported by extensive detail • provokes and sustains the reader's interest through effective and precise language, sentence structure, and vocabulary
Writing Conventions	• writes compositions with partial control of the standard English conventions of grammar, spelling, punctuation, and usage	• writes compositions with solid control of the standard English conventions of grammar, spelling, punctuation, and usage	• writes compositions with sophisticated control of the standard English conventions of grammar, spelling, punctuation, and usage

Mathematics

Student results on the MCAS tests are reported according to four performance levels: *Failing, Needs Improvement, Proficient,* and *Advanced.* The selected descriptors below illustrate the kinds of knowledge and skills students demonstrate on MCAS at each level. Knowledge and skills are cumulative at each level. No descriptors are provided for the *Failing* performance level because student work at this level, by definition, does not meet the criteria of the *Needs Improvement* level.

Mathematics Curriculum Framework Core Concept: Students develop mathematical power through problem solving, communication, reasoning, and connections.

	Needs Improvement On MCAS, a student at this level:	**Proficient On MCAS, a student at this level:**	**Advanced On MCAS, a student at this level:**
Conceptual Understanding and Procedural Knowledge	• demonstrates partial understanding of our numeration system • performs	• demonstrates solid understanding of our numeration system • performs most	• connects concepts from various areas of mathematics, and uses
Problem Solving	• applies learned procedures to solve routine problems	• applies learned procedures and mathematical concepts to solve a variety of problems, including	• generates unique strategies and procedures to solve non-routine
Mathematical Reasoning	• applies some reasoning methods to solve simple problems	• uses a variety of reasoning methods to solve problems	• uses multiple reasoning methods to solve complex problems

	problems	• explains steps and procedures	solve complex problems • justifies strategies and solutions
Mathematical Communication	• identifies and uses basic mathematical terms	• uses various forms of representation (e.g., text, graphs, symbols) to illustrate steps to a solution	• uses various forms of representat ion (e.g., text, graphs, symbols) to justify solutions and solution strategies

Science and Technology/Engineering

Student results on the MCAS tests are reported according to four performance levels: *Failing, Needs Improvement, Proficient, and Advanced.* The selected descriptors below illustrate the kinds of knowledge and skills students demonstrate on MCAS at each level. Knowledge and skills are cumulative at each level. No descriptors are provided for the *Failing* performance level because student work at this level, by definition, does not meet the criteria of the *Needs Improvement* level.

Science & Technology Curriculum Framework Core Concept: Owning the questions

	Needs Improvement On MCAS, a student at this level:	**Proficient On MCAS, a student at this level:**	**Advanced On MCAS, a student at this level:**
Concepts	• understands some basic concepts and principles and shows partial understandin g of others	• demonstrates solid understanding of many concepts, principles, and theories	• demonstrates in-depth understandin g of concepts, principles, and theories
Applications	• offers partial solutions to problems involving scientific or technological ideas	• applies scientific or technological knowledge to solve some problems	• applies scientific or technological knowledge to solve complex problems

Communication	• uses some basic scientific or technological terminology in limited explanations of phenomena	• usually uses correct scientific or technological terminology in explanations of phenomena	• uses correct scientific or technological terminology in detailed explanations of phenomena
Process	• shows some understanding of and can perform some steps of an investigation or design process • records data and observes simple patterns	• provides descriptions of workable designs or solutions for investigations • makes reasonable interpretations and conclusions based on data	• provides detailed descriptions of effective designs or solutions for investigations • uses a variety of means to analyze data and draws defensible conclusions

History and Social Science

Student results on the MCAS tests are reported according to four performance levels: *Failing, Needs Improvement, Proficient, and Advanced.* The selected descriptors below illustrate the kinds of knowledge and skills students demonstrate on MCAS at each level. No descriptors are provided for the *Failing* performance level because student work at this level, by definition, does not meet the criteria of the *Needs Improvement* level.

	Needs Improvement On MCAS, a student at this level:	**Proficient On MCAS, a student at this level:**	**Advanced On MCAS, a student at this level:**
Knowledge: *Facts and Skills*	• demonstrates some understanding of basic factual knowledge • shows partial understanding of the chronology of historical events • uses limited history and social science terminology and skills	• demonstrates a general command of factual knowledge • shows understanding of the chronology of historical events and relationships among them • uses history and social science terminology and skills	• demonstrates a comprehensive understanding of factual knowledge • shows comprehensive and in-depth understanding of the chronology of historical events and relationships among them

		and skills	• uses sophisticated history and social science terminology and skills
Abstract Ideas: *Concepts, Principles, and Theories*	• demonstrates some understanding of simple concepts, principles, and theories	• demonstrates solid understanding of simple concepts, principles, and theories, and some understanding of complex concepts, principles, and theories	• demonstrates comprehensive and in-depth understanding of complex concepts, principles, and theories
Reasoning: *Analyzing, Connecting, Interpreting, Applying, and Evaluating*	• provides simple explanations of events or concepts with limited support • makes simple and/or partial connections • makes limited interpretations of evidence	• provides clear and accurate explanations of events or concepts supported by evidence • makes some abstract connections • makes clear and logical interpretations of evidence • substantiates some judgments using evidence	• provides comprehensive and in-depth explanations of events or concepts supported by detailed evidence • makes complex and subtle connections • makes sophisticated interpretations of evidence • makes well-substantiated judgments presenting convincing evidence

Appendix C

Sample Grade 8 MCAS Mathematics Section

X. Mathematics, Grade 8

Session 1, Multiple-Choice Questions

1 (0.5)(0.5)(0.5) is equal to which of the following?

A. 0.000125

B. 0.00125

✔ C. 0.125

D. 1.25

Reporting Category for Item 1: ***Number Sense and Operations*** (p. 295)

2 Which is the **best** approximation of $\sqrt{72}$?

A. 7.2

B. 9.1

C. 8.9

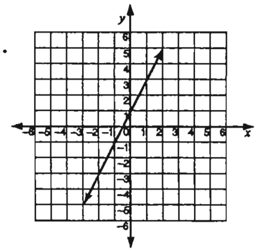
✔ D. 8.5

Reporting Category for Item 2: ***Number Sense and Operations*** (p. 295)

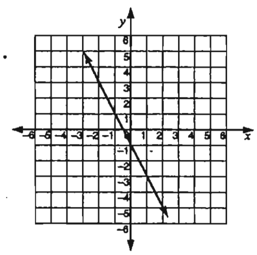
3 Which graph contains the points given in the table below?

x	y
⁻2	3
⁻1	1
1	⁻3

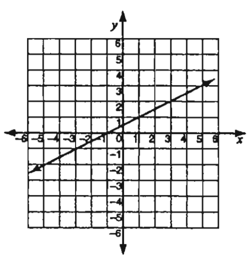
A.



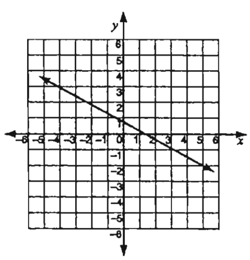
✔ B.



C.



D.



Reporting Category for Item 3: **Patterns, Relations, and Algebra** (p. 296)

Use the chart below to answer question 4.

Input	3	4	5	6	. . .	*n*
Output	10	13	16	19	. . .	?

4 If the input is n, what will the output be?

A. $n + 3$

B. $n + 7$

C. $3(n + 2) + 1$

✔ D. $3n + 1$

Reporting Category for Item 4: ***Patterns, Relations, and Algebra*** (p. 296)

5 A hole in a piece of metal has a diameter of $3\frac{1}{2}$ inches. Which of the following pipes is the largest that will fit through the hole?

A. a pipe with a diameter of $3\frac{3}{8}$ inches

B. a pipe with a diameter of $3\frac{7}{8}$ inches

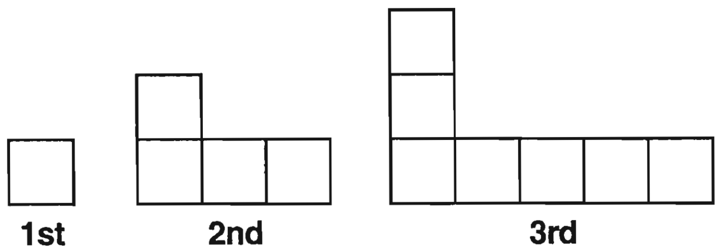
C. a pipe with a diameter of $3\frac{5}{16}$ inches

✔ D. a pipe with a diameter of $3\frac{7}{16}$ inches

Reporting Category for Item 5: ***Number Sense and Operations*** (p. 295)

Session 1, Short-Answer Questions

6 Each arrangement in this pattern is made up of tiles.



How many tiles will be in the 6th arrangement in the pattern?

Correct Answer:
16

Reporting Category for Item 6: ***Patterns, Relations, and Algebra*** (p. 296)

7 Compute:

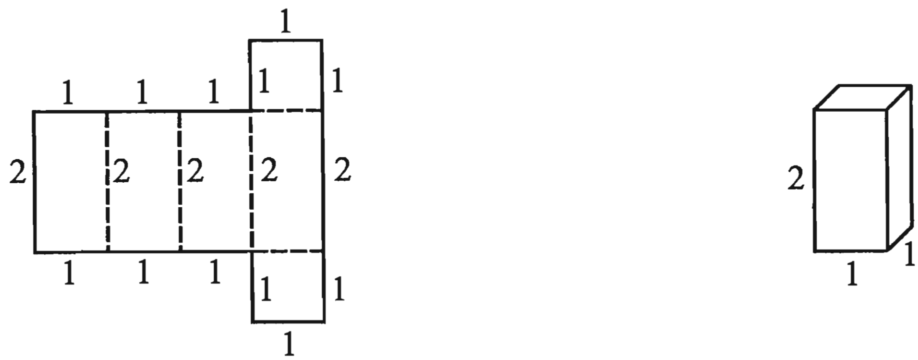
$$8 - (-5 + 3 \times 7) =$$

Correct Answer:
−8

Reporting Category for Item 7: ***Number Sense and Operations*** (p. 295)

Session 1, Open-Response Question

8 The pattern shown below is for a square prism. The lengths of the line segments in the pattern were chosen so that the pattern could be folded along the dotted lines into the prism shown.



a. Make a sketch of a pattern for a triangular prism. Label **each** line segment with a length that will make it possible to fold the pattern into the triangular prism.

b. Make a sketch of a pattern for a cylinder. Label **each** line segment and diameter in your pattern with a length that will make it possible to create the cylinder from the pattern.

Reporting Category for Item 8: ***Geometry*** (p. 297)

Session 1, Short-Answer Questions

9 25% of what number is 100?

Correct Answer:
400

Reporting Category for Item 9: ***Number Sense and Operations*** **(p. 295)**

10 Compute:

$$(-4)^3 =$$

Correct Answer:
-64

Reporting Category for Item 10: ***Number Sense and Operations*** **(p. 295)**

11 What does x equal in the equation below?

$$\frac{3x}{4} - 2 = 7$$

Correct Answer:
12 or $x = 12$

Reporting Category for Item 11: ***Patterns, Relations, and Algebra*** **(p. 296)**

Session 1, Open-Response Question

12 An eighth-grade class will perform the first **four** acts in the annual talent show. Every student is in exactly one of the four acts. The order in which the acts will be presented is to be decided by a drawing so that each act has an equal chance of being drawn.

a. Chantal is a member of the eighth-grade class. What is the probability that her act will be presented first?

b. Chantal's act was chosen to be presented first. Make a tree diagram, chart, or list showing all the possible orders in which the **other three acts** could be presented. Use the letters A, B, and C to represent these three acts.

c. Rory, Jesse, and Chantal are all members of the eighth-grade class who will each perform an act. What is the probability that Rory's act will immediately follow Jesse's? Explain how you found your answer.

Reporting Category for Item 12: ***Data Analysis, Statistics, and Probability*** (p. 298)

Appendix D

Sample Grade 8 MCAS English Language Arts Section

VI. English Language Arts, Grade 8

A. Composition
B. Language and Literature

Grade 8 Writing Prompt

Each year many children are involved in accidents while riding on their bikes, scooters, or while skateboarding, rollerblading, and skiing. Some people suggest that there should be a law requiring a person under the age of 16 to wear a helmet while engaging in any of these activities. Others disagree, arguing that wearing protective gear like helmets takes all the fun out of these sports.

Imagine that Massachusetts is considering such a law. Your class has been assigned to write an essay for the state legislature. Your essay will be sent to lawmakers who will then decide whether to draft the new law and put it to a vote.

WRITING ASSIGNMENT

Write a persuasive essay stating whether children under the age of 16 should be required to wear helmets while biking, scooting, skateboarding, rollerblading, and skiing. Give at least two reasons to support your position.

Remember, you must argue in such a convincing manner that others will agree with you. The outcome of the state legislature's vote on helmets could be decided by your essay.

*Reporting Category/*Learning Standard for Item 1: ***Composition/*Learning Standards 19-22 (p. 159)**

Grade 8 Make-up Prompt

Suppose the school committee is considering a proposal to lengthen the school day by two hours. During these two hours, all students would remain in their classrooms to get help with their homework from teachers, parents, or volunteers. Some people suggest that this additional time would help students improve their schoolwork and grades. Others disagree, arguing that the school day is long enough and that children should be able to enjoy some free time.

Imagine that everyone in your classroom is writing an essay about this idea. The best essays will be provided for a committee of parents and teachers to consider as they try to decide whether this new plan is a good idea.

WRITING ASSIGNMENT

Write a persuasive essay stating whether the school day should be lengthened by two hours so that all students can get help with homework. Give at least two reasons to support your position.

Remember, you must argue in such a convincing manner that others will agree with you. Whether or not two hours will be added to your school day to work on homework could depend on what you write.

*Reporting Category/*Learning Standard for Item 1 (Make-up Prompt): ***Composition/*Learning Standards 19-22 (p. 159)**

Session 1, Reading Selection #1

The Inner Tube *by Gary Soto tells about a plan that worked out even better than expected. Read the story and answer the questions that follow.*

THE INNER TUBE

by Gary Soto

1 The tractor inner tube hung in defeat on a nail, accompanied by three flies swinging back and forth, sentries of all that goes unused in a garage. The heat was oppressive for July, especially so for a one-car garage full of the smells of paint remover and open jars of red salmon eggs. I stepped over boxes of old clothes and warped magazines, a lawn mower, and oily engine parts. I kicked over a lampshade, the bulb bursting its brittle glass, and pushed aside fishing tackle. I reached for the inner tube and touched the rigging of a spider web. I pulled it off quickly and leaped through the debris to the patio. Sweat flooded my face and forked down my arms. I grabbed our hose and washed the inner tube, a slack mouth that I carried over my shoulder to a friend's house.

2 David had a tire patch kit. He inflated the inner tube with a bicycle pump, and it filled unevenly, one side growing fat like a swollen mouth backhanded by a mean brother. He let the air out, stomped it flat as a shadow, and tried again. Again the air swelled to one side. We stared at the inner tube in confusion.

3 I asked, "What's wrong with it?"

4 David didn't say anything. Instead, he jumped up and down on the fat side, but although I joined his weight, laughing as I jumped, the air wouldn't move to the skinny side. After that, we stopped because there was no time to waste. Kathy's pool party was at 1:00, and it was already a quarter after twelve.

5 We lowered our ears and listened for the hiss of air.

6 "Put your finger there," David said once we found the puncture. I licked a finger and pressed it into the deflating tube while he squeezed the glue and got the matches ready. But first he scratched the puncture so the patch would stick. I removed my finger, and he buffed the tube back and forth with the rough lid of the tire patch kit. He then smeared the glue and lit the match, the blue flame exciting us for a few seconds. He quickly fit the patch over the puncture and counted to twenty before taking his finger away. We lassoed the inner tube, now nearly deflated, onto the handlebars of my bicycle.

7 We sat under his cool sycamore waiting for the patch to dry. I asked David what went on at a "pool party," and he said he thought there would be cake and ice cream and races in the pool. I thought about this for a while. The only party that I knew was a birthday party, so when I received an invitation in the mail to a "pool party," I thought it involved the kind of *pool* that my stepfather and uncle shot at Uncle Tom's Tavern. After I caught on, I began to plan what to wear and what to take. I had a snorkel and fins, but my brother had lent the snorkel to his loudmouth friends and it disgusted me that I should fill my mouth with the rubber thing that others had sucked in dirty canals. And the fins were too small; they left painful rings on the insteps of my feet. At the last minute I remembered the inner tube.

8 David and I got up and poked the patch tenderly, as if it were a wound. The inner tube was healed. He pumped it up until it was huge, and a hollow *thump* resounded when I flicked a finger against the taut skin. I got on my bicycle, and with the inner tube crossed over my shoulder, David gave me a good push. The bike wobbled, but straightened as my legs strained for speed. I was off to a "pool party."

9 By the time I arrived I was sweaty and nearly dead from not seeing oncoming cars, because every time I turned left the inner tube blocked my view of the road.

10 The mother who answered the door clapped her hands and said, "Wow!" When I had difficulty getting the inner tube through the front door, she suggested that I go along the side of the house to the backyard. I rolled and pushed and lugged the inner tube, and when everyone saw me come around a bush, they yelled, "Gary's got a tire." I was more than sweaty. My once clean T-shirt was now smeared black along the front, and my hair, earlier parted on the right side and smelling sweetly of Wildroot hair cream, was flat as a blown-over hut. I licked my lips and tasted the hair cream.

11 When Kathy said hello, I waved my invitation at her and told her I nearly got killed by three cars. Then I jumped into the pool and stayed under for a long time. I was hot, so oiled up by the two-mile ride with an inner tube on my shoulder. I surfaced, got out, and threw the tube in the water. Someone asked, "How come it's big on one side?"

12 I shrugged, leaped in, and came up among an armada of pink and yellow air mattresses and an inflated plastic swan with a drooping neck. I tried to climb onto the swan, but it sank under my weight. I swam over to my tube, which was like a doctor's couch on the water, huge and plush. Two boys joined me, then a girl, and finally Kathy and her best friend. We floated around the pool, pushing aside the air mattresses and dunking the plastic swan for good. We stood up on the tube, the boys on the fat side, the girls on the skinny side, and bounced up and down, sometimes falling off but quickly climbing back on. We jumped and laughed, until a toe peeled off the patch and our feet began to mash the deflating tube. Stinky bubbles hissed on the water, and we began to sink, very slowly and happily.

13 The "pool party" was more than cake and ice cream. We had burgers as well, with potato chips and plenty of punch. I swam as much as I could. By the time I left—the last boy to go home—my eyes were red and my hair was parted down the middle from diving a hundred times into the pool. I enjoyed a cool ride home with the breathless inner tube hanging exhausted around my neck.

Session 1, Multiple-Choice Questions

2 In paragraph 1 the author says, "Sweat flooded my face and forked down my arms." What does *forked* mean?

✔ A. ran in separate streams

B. scraped and scratched

C. poured

D. gleamed

*Reporting Category/*Learning Standard for Item 2: ***Literature/*****Learning Standard 8 (p. 163)**

3 Gary took the inner tube to David's house because

A. he wanted David to see it.

B. they were going to the pool party together.

✔ C. he needed help inflating it.

D. David knew how to fix its lopsidedness.

*Reporting Category/*Learning Standard for Item 3: ***Literature/*****Learning Standard 9 (p. 163)**

4 With what characteristic of the inflated inner tube were the boys dissatisfied?

A. size

✔ B. shape

C. color

D. smell

*Reporting Category/*Learning Standard for Item 4: ***Literature/*****Learning Standard 9 (p. 163)**

5 The author includes the discussion between the boys about what a pool party is in order to

✔ A. show that Gary has never been to a pool party before.

B. illustrate that David is much older than Gary.

C. help the reader understand what will happen at the pool party.

D. indicate that Gary did not want to go to the pool party.

*Reporting Category/*Learning Standard for Item 5: ***Literature/*****Learning Standard 12 (p. 163)**

6 "At the last minute I remembered the inner tube." A comma could be inserted correctly after which of the following words?

A. last

✔ B. minute

C. I

D. remembered

Reporting Category/Learning Standard for Item 6: ***Language***/**Learning Standard 5 (p. 162)**

7 When she saw the inner tube, the mother who answered the door was

A. confused.

B. disappointed.

C. dismayed.

✔ D. impressed.

Reporting Category/Learning Standard for Item 7: ***Literature***/**Learning Standard 9 (p. 163)**

8 In paragraph 12, the author uses the word "armada," which means a naval force of many ships, to suggest the

A. partygoers had been fighting.

B. difference between the inner tube and the air mattresses.

✔ C. large number of plastic air mattresses.

D. feeling Gary had of being attacked.

Reporting Category/Learning Standard for Item 8: ***Literature***/**Learning Standard 15 (p. 163)**

9 Describing the inner tube as having a "slack mouth" and being "breathless" and "exhausted" are examples of

A. onomatopoeia.

B. alliteration.

C. irony.

✔ D. personification.

Reporting Category/Learning Standard for Item 9: ***Literature***/**Learning Standard 15 (p. 163)**

Session 1, Open-Response Question

10 Describe Gary's personality. Explain your answer using information from the story as evidence.

Reporting Category/Learning Standard for Item 10: ***Literature***/**Learning Standard 12 (p. 163)**

Appendix E

Sample Grade 10 MCAS Mathematics Section

XI. Mathematics, Grade 10

Session 1, Multiple-Choice Questions

1 The value of $\frac{51.92 \times 202}{4.93}$ is closest to

A. 20.

B. 200.

✔ C. 2,000.

D. 20,000.

Reporting Category for Item 1: ***Number Sense and Operations*** **(p. 325)**

2 If $4 + 2(3x - 4) = 8$, then $3x - 4$ equals

A. 4.

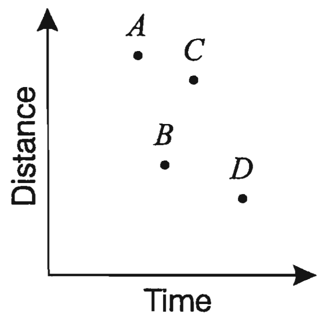
✔ B. 2.

C. 8.

D. 6.

Reporting Category for Item 2: ***Number Sense and Operations*** **(p. 325)**

3 The scatter plot below gives information about four different car trips.



Which point represents the trip with the fastest average speed?

✔ A. point *A*

B. point *B*

C. point *C*

D. point *D*

Reporting Category for Item 3: ***Data Analysis, Statistics, and Probability*** (p. 328)

4 $2^4 \cdot 3^4$ is the same as

A. 5^4.

B. 5^8.

✔ C. 6^4.

D. 6^8.

Reporting Category for Item 4: ***Number Sense and Operations*** (p. 325)

5 Let a, x, and y represent real numbers with $a > 0$ and $x > y$. Which of the following statements is **not** true?

A. $ax > ay$

✔ B. $ay > ax$

C. $x + a > y + a$

D. $x - a > y - a$

Reporting Category for Item 5: ***Number Sense and Operations*** (p. 325)

6 $2\sqrt{5}$ is between

A. 2 and 3.

✔ B. 4 and 6.

C. 6 and 9.

D. 9 and 12.

Reporting Category for Item 6: ***Number Sense and Operations*** (p. 325)

7 The sophomore class plans to sell T-shirts with the school's name on them. The cost of each T-shirt alone is \$3.50, and the printing cost of each is \$0.75. If the class plans on selling each printed T-shirt for \$11, what expression can you use to calculate the class profit for selling n printed T-shirts?

A. $11.00 - (3.50 + 0.75)n$

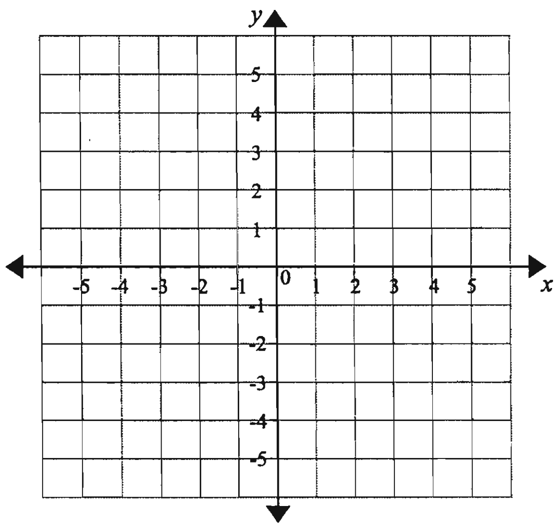
B. $11.00n - (3.50 + 0.75)$

C. $11.00 - 3.50 - 0.75n$

✔ D. $(11.00 - 3.50 - 0.75)n$

Reporting Category for Item 7: ***Patterns, Relations, and Algebra*** (p. 326)

You may want to use the following coordinate plane to help you answer question 8.



8 As the result of a transformation, the image of the point $(-1,3)$ is $(-3,1)$. This is an example of a reflection across the

A. line $y = x$.

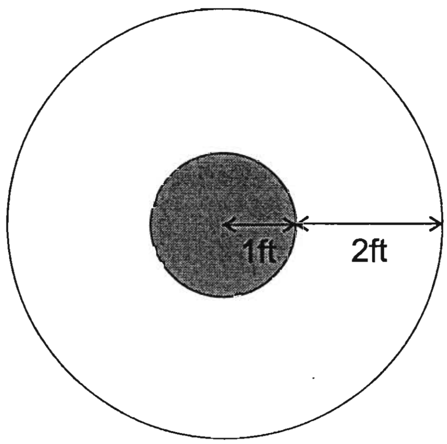
✔ B. line $y = -x$.

C. x-axis.

D. y-axis.

Reporting Category for Item 8: ***Geometry*** **(p. 326)**

9 Julie designed a target computer game. On her computer screen, the circular targets look like the circular areas shown below.



If the computer randomly generates a dot that lands within the circular areas, what is the approximate probability that the dot will land in the **shaded** area?

✔ A. $\frac{1}{9}$

B. $\frac{2}{9}$

C. $\frac{1}{3}$

D. $\frac{2}{3}$

Reporting Category for Item 9: ***Data Analysis, Statistics, and Probability*** (p. 328)

10 Which of the following is **always** true?

✔ A. The product of any two integers is an integer.

B. The quotient of any two integers is an integer.

C. The product of any two irrational numbers is irrational.

D. The quotient of any two irrational numbers is irrational.

Reporting Category for Item 10: ***Number Sense and Operations*** **(p. 325)**

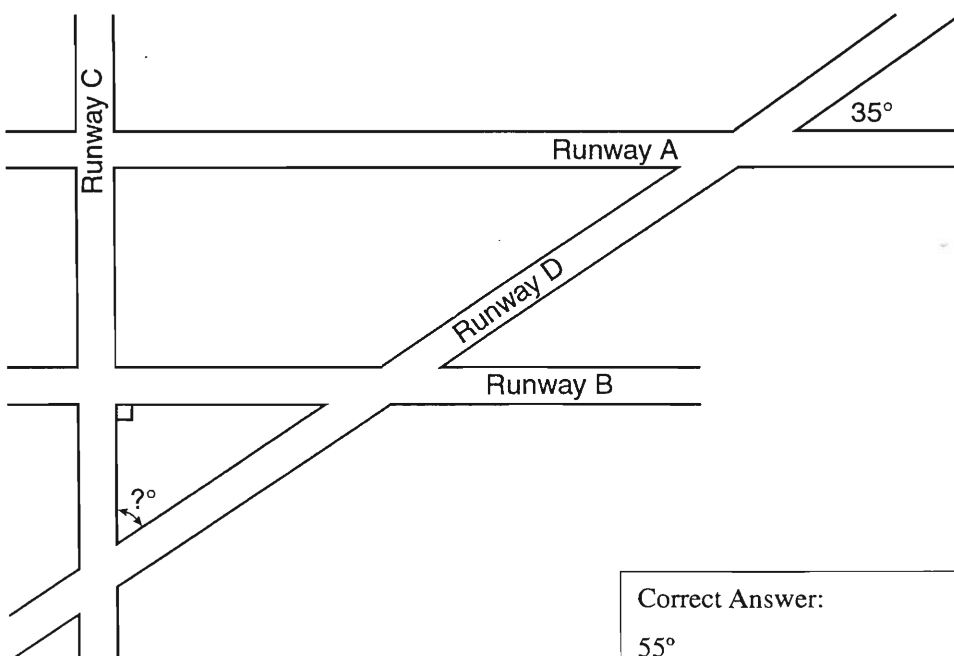
Session 1, Short-Answer Questions

11 In Oak Park, a picnic table is located 70 feet from the water fountain and 90 feet from the swings. What is the longest possible distance that the water fountain could be from the swings?

Correct Answer:
160 feet

Reporting Category for Item 11: ***Geometry*** (p. 326)

Use the diagram below to answer question 12.



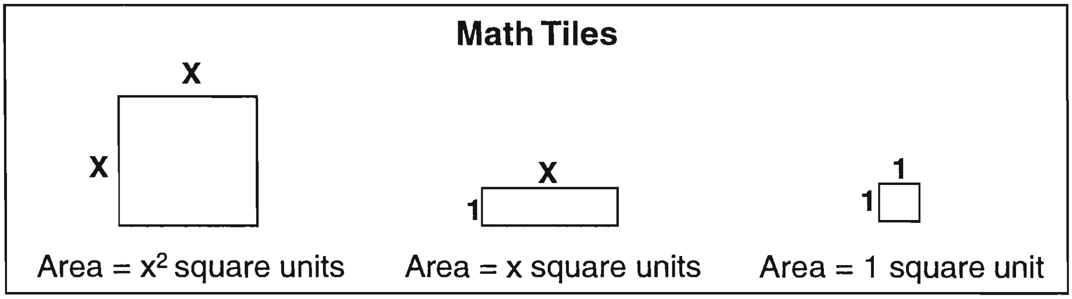
Correct Answer:
55°

12 Runways A and B are parallel to each other and perpendicular to Runway C. If Runway D makes a 35° angle with Runway A as shown in the diagram, what is the measure of the angle marked in the diagram between Runways C and D?

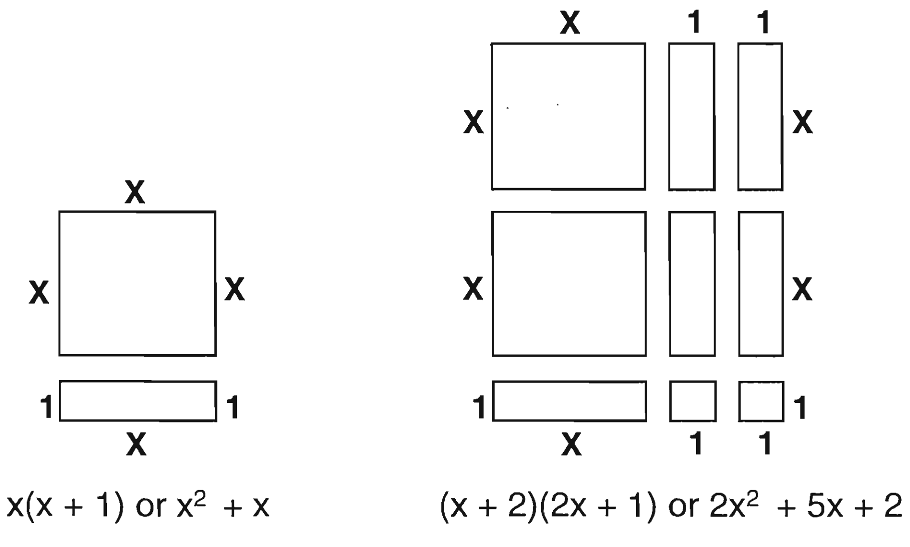
Reporting Category for Item 12: ***Geometry*** (p. 326)

Session 1, Open-Response Question

Use the figure below to answer question 13.



13 In the figures below, math tiles were used to build rectangular arrays to represent each of the quadratic expressions.



a. Show how to build rectangular arrays, if possible, for each of the following expressions using the three math tiles.

$2x^2 + 3x + 1$ $\quad$ $3x^2 + 2x$ $\quad$ $3x^2 + 6x + 5$

b. How can you determine if a rectangular array can be built for an expression?

Reporting Category for Item 13: ***Patterns, Relations, and Algebra*** **(p. 326)**

Session 1, Short-Answer Questions

14 Find **all** the values of x that satisfy the following equation.

$$x^2 + 2x - 15 = 0$$

Correct Answer:

$-5, 3$, or $x = -5$ and $x = 3$

Reporting Category for Item 14: ***Patterns, Relations, and Algebra*** (p. 326)

15 At the first stop, $\frac{3}{4}$ of the passengers on the bus got off and 8 people got on. A total of 16 passengers were left on the bus. Write an equation that can be solved to find how many passengers were on the bus before the first stop. Let x represent the number of passengers on the bus before the first stop. (You do **not** have to solve the equation.)

Correct Answer:

$\frac{1}{4}x + 8 = 16$ or equivalent equation

Reporting Category for Item 15: ***Patterns, Relations, and Algebra*** (p. 326)

Session 1, Open-Response Question

16 When Elena works on Saturdays, she buys a salad and juice for lunch. There are two take-out restaurants near where she works. The prices in the two restaurants are given below.

Hector's To-Go	
Juice.................	$2.00 per bottle
Salad bar..........	25¢ per ounce

Tammy's Take-Out	
Juice.................	$1.00 per bottle
Salad bar..........	50¢ per ounce

a. How many ounces of salad, together with a bottle of juice, can Elena buy at Hector's To-Go for $4.50?

b. Write an equation that shows the cost, *C*, of Elena's lunch at Hector's To-Go if she buys a bottle of juice and *n* ounces of salad.

c. On the grid in your Student Answer Booklet, graph the equation you wrote in part b.

- Use the horizontal axis for the number of ounces, with each increment representing one ounce.
- Use the vertical axis for cost, with each increment representing 50¢.

d. What are the different amounts of salad that Elena can buy so her complete lunch is less expensive at Tammy's Take-Out than at Hector's To-Go? Remember that Elena always buys a bottle of juice with her salad. Show or explain how you found your answer.

Reporting Category for Item 16: ***Patterns, Relations, and Algebra*** (p. 326)

Appendix F

Sample Grade 10 MCAS English Language Arts Section

VII. English Language Arts, Grade 10

A. Composition
B. Language and Literature

Grade 10 Writing Prompt

WRITING ASSIGNMENT

A frequent theme in literature is the conflict between the individual and society.

From a work of literature you have read in or out of school, select a character who struggles with society. In a well-developed composition, identify the character and explain why this character's conflict with society is important.

*Reporting Category/*Learning Standards for Item 1: ***Composition/*Learning Standards 19-22 (p. 193)**

Grade 10 Make-up Prompt

WRITING ASSIGNMENT

Often in literature one moment or event stands out.

From a work of literature you have read in or out of school, select an important moment or event. In a well-developed composition, identify the moment or event and explain why it is important.

*Reporting Category/*Learning Standards for Item 1 (Make-up Prompt): ***Composition/*Learning Standards 19-22 (p. 193)**

Session 1, Reading Selection #1

This article from The New Yorker *magazine explains how one determined person obtained her desired job. Read the article and answer the questions that follow.*

Lego
from *The New Yorker*
January 14, 1991

1 Growing up in Queens in the sixties and seventies, Francie Berger knew exactly what she wanted from life: more Lego building bricks. She received her first set, a gift from her parents, when she was three. Gradually, she added to her holdings. She liked to build houses, and she wished that she could build bigger ones. As a teenager, she began writing to Lego Systems, Inc., the American division of the toy's Danish manufacturer, to ask if she could order, say, two million standard red bricks. The company said that she could not. In college—where she majored in architecture, figuring that building real houses was the adult occupation that came closest to her favorite activity—she wrote more letters. At some point, it occurred to her that she might be able to get a job at Lego itself. She began calling the company on a monthly basis, and she once dropped by its headquarters, in Enfield, Connecticut. "By then," Berger recalls, "they knew who I was." The person who was dispatched to get rid of her told her to send a resume, by mail, after graduation. Undeterred, she spent part of her senior year using Lego bricks to build a scale model of a farm. The model served both as her senior thesis and as a job application. Seeing no way out, Lego hired her, in 1984, for a three-week trial period. She has been with the company ever since, and is perhaps the most satisfied worker in the history of employment.

2 Berger's job is building things out of Lego bricks. Her works include the six-foot-tall red-bearded pirate that stands in the Lego department of F.A.O. Schwartz, on Fifth Avenue, and the six-foot-tall roller coaster, part of an animal amusement park, in the window of the Toys "R" Us in Herald Square. They also include the thirteen-foot-tall (and twenty-seven-and-a-half-foot-wide) replica of the United States Capitol which, along with a number of models of other national landmarks and monuments, recently spent a little more than a month on display at A. & S. Plaza, on West Thirty-third Street. All these models are made entirely of Lego bricks (the Capitol contains more than half a million), and all were assembled by Lego's staff of model-designers and model-

builders, of which Berger is the head. The company uses the models as promotions. The Capitol was part of a travelling show that visited ten shopping malls during 1990 and is now in the process of being split up and parcelled out to various children's museums. Most people, upon seeing the Capitol model, have two reactions. The first is "Hey, the White House!" The second is "I can't believe somebody built that out of Lego bricks!"

3 "When we build a model, we don't use any bricks that you can't buy in stores, and we don't alter them or cut them or do anything weird to them," Berger told us not long ago, when we went to visit her in Enfield. "First, the designers draw the model on special graph paper that is scaled to the bricks. Then they build a prototype without gluing it, to prove that it can be done. Then the model-builders make an exact copy and glue it together. They also make sure it's as hollow as possible, so it will be easier to move around." Some of the moving around is done in two custom-built air-ride semitrailers.

4 Lego's model-builders work at long tables that can be raised and lowered hydraulically. The tables are connected to an elaborate ventilation system that whisks away fumes from the glue, which is kept in Elmer's bottles but is actually methyl ethyl ketone, a potent solvent that causes the plastic of the bricks to fuse. Once a model has been glued, it can be taken out into the parking lot of a shopping mall, say, and washed down with a garden hose or scrubbed with Formula 409. It can also be left outside for just about as long as you like. The visitors' parking lot at the company headquarters is furnished with an earlier version of the Capitol model, which is kept there year-round. . . .

5 Berger's job didn't exist when she was hired. At that time, all the models used by Lego's American division were made in Denmark and shipped to the United States. To Berger, that seemed nutty. Why not build those models right here in America, and why not let Francie Berger build them? Today, she supervises two other designers and half a dozen full-time model-builders. All these people are, in effect, manifestations of her determination to spend her life doing the thing she likes best.

Session 1, Multiple-Choice Questions

2 According to this article, why did Francie Berger major in architecture?

✔ A. Architecture reminded her of playing with Lego bricks.

B. Her father, an architect, wanted her to enter his occupation.

C. Lego Systems, Inc. encouraged her to be an architect.

D. Architecture is a very high-paying profession.

Reporting Category/Learning Standard for Item 2: ***Literature***/**Learning Standard 9 (p. 197)**

3 In paragraph 1, the author's statement, "Seeing no way out, Lego hired her . . ." means that

A. Lego Systems, Inc. legally could not deny Francie employment.

B. architects had proven to be the company's best employees.

C. the company was severely understaffed and needed employees.

✔ D. Francie proved to the company that she would be a suitable employee.

Reporting Category/Learning Standard for Item 3: ***Literature***/**Learning Standard 13 (p. 197)**

4 What is the main reason Lego Systems, Inc. sends large models of buildings to various sites?

✔ A. It is good advertising for the company.

B. They are created as donations to museums.

C. The models show special Lego bricks to the public.

D. It is the only way some people can see these buildings.

Reporting Category/Learning Standard for Item 4: ***Literature***/**Learning Standard 9 (p. 197)**

5 When building a model, Lego's staff of model-designers and model-builders do all of the following **except**

A. use bricks that are available to everyone.

B. draw the model on special graph paper.

C. build an exact-scale prototype.

✔ D. attach wheels to the bottom of the model.

Reporting Category/Learning Standard for Item 5: ***Literature***/**Learning Standard 9 (p. 197)**

6 In the sentence, “Lego’s model-builders work at long tables that can be raised and lowered hydraulically,” what part of speech is the word *hydraulically*?

A. adjective

B. verb

✔ C. adverb

D. noun

*Reporting Category/*Learning Standard for Item 6: ***Language/*Learning Standard 5 (p. 196)**

7 The author mentions that the large models made by Lego’s staff can be washed and scrubbed in order to emphasize the

A. cleanliness of the Lego operation.

B. company’s concern for the environment.

✔ C. solid construction of the models.

D. authenticity of the Lego bricks.

*Reporting Category/*Learning Standard for Item 7: ***Literature/*Learning Standard 13 (p. 197)**

8 Which best describes the content of this article?

A. persuasive

B. autobiographical

✔ C. informational

D. fictional

*Reporting Category/*Learning Standard for Item 8: ***Literature/*Learning Standard 10 (p. 197)**

Session 1, Open-Response Question

9. Mark Twain said, "Make your vocation your vacation." Explain how this quotation relates to this article. Use specific evidence from the article to support your answer.

Reporting Category/Learning Standard for Item 9: ***Literature*/Learning Standard 13 (p. 197)**

Appendix G

Sample Scoring Guides for the 2001 MCAS test

Examples of Grade 8 English Composition Scoring Guides

2001 MCAS Sample Student Work

MCAS Student Work: Grade 8 English Language Arts Composition

NOTE: *The sample responses provided here are selections of actual student work from the MCAS administered in Spring 2001. In order to protect individual students' privacy, all names and references of a personal nature have been altered or removed. The responses have been recopied exactly as the student wrote them.*

Each year many children are involved in accidents while riding on their bikes, scooters, or while skateboarding, rollerblading, and skiing. Some people suggest that there should be a law requiring a person under the age of 16 to wear a helmet while engaging in any of these activities. Others disagree, arguing that wearing protective gear like helmets takes all the fun out of these sports.
Imagine that Massachusetts is considering such a law. Your class has been assigned to write an essay for the state legislature. Your essay will be sent to lawmakers who will then decide whether to draft the new law and put it to a vote.

Writing Assignment
Write a persuasive essay stating whether children under the age of 16 should be required to wear helmets while biking, scooting, skateboarding, rollerblading, and skiing. Give at least two reason to support your position.
Remember, you must argue in such a convincing manner that others will agree with you. The outcome of the state legislature's vote on helmets could be decided by your essay.

Scoring Guide for Topic/Idea Development

View Score	Description
6 Points	• Rich topic/idea development • Careful and/or subtle organization • Effective/rich use of language
5 Points	• Full topic/idea development • Logical organization • Strong details • Appropriate use of language
4 Points	• Moderate topic/idea development and organization • Adequate, relevant details • Some variety in language
3 Points	• Rudimentary topic/idea development • Basic supporting details • Simplistic language
2 Points	• Limited or weak topic/idea development, organization, and/or details • Limited awareness of audience and/or task
1 Point	• Limited topic/idea development, organization, and/or details

	• Little or no awareness of audience and/or task
Blank	No response.

*Compositions were scored 1-6 on *Topic Development* and 1-4 on *Conventions*.

Scoring Guide for Standard English Conventions

View Score	Description
4 Points	• Control of sentence structure, grammar and usage, and mechanics (length and complexity of essay provide opportunity for student to show control of standard English conventions)
3 Points	• Errors do not interfere with communication and/or • Few errors relative to length of essay or complexity of sentence structure, grammar and usage, and mechanics
2 Points	• Errors interfere somewhat with communication and/or • Too many errors relative to the length of the essay or complexity of sentence structure, grammar and usage, and mechanics
1 Point	• Errors seriously interfere with communication AND • Little control of sentence structure, grammar and usage, and mechanics
Blank	No response.

*Compositions were scored 1-6 on *Topic Development* and 1-4 on *Conventions*.

Example of Grade 8 Language and Literature Scoring Guide

2001 MCAS Sample Student Work
MCAS Student Work: Grade 8 English Language Arts (Language and Literature)

NOTE: *The sample responses provided here are selections of actual student work from the MCAS administered in Spring 2001. In order to protect individual students' privacy, all names and references of a personal nature have been altered or removed. The responses have been recopied exactly as the student wrote them.*

Open Response Question 10

Describe Gary's personality. Explain your answer using information from the story as evidence.

Scoring Guide

Score	Description
4	Response provides an insightful description of Gary's personality using relevant information from the story to thoroughly explain his/her reasoning.
3	Response provides a general; but not fully developed, description of Gary's personality using appropriate information from the story to explain his/her reasoning.
2	Response provides a basic description of Gary's personality, using limited information from the story to explain his/her reasoning, but information is not adequately developed and/or may contain some misunderstandings.
1	Response provides a vague description of Gary's personality with little or no information to explain his/her reasoning indicating a minimal understanding of the question.
0	Response is totally incorrect or irrelevant.
Blank	No response.

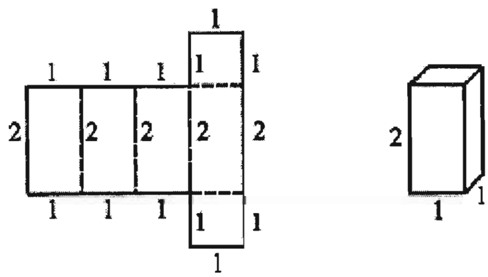
Examples of Grade 8 Mathematics Scoring Guides

2001 MCAS Sample Student Work
MCAS Student Work: Grade 8 Mathematics

NOTE: *The sample responses provided here are selections of actual student work from the MCAS administered in Spring 2001. In order to protect individual students' privacy, all names and references of a personal nature have been altered or removed. The responses have been recopied exactly as the student wrote them.*

Open Response Question 8

The pattern shown below is for a square prism. The lengths of the line segments in the pattern were chosen so that the pattern could be folded along the dotted lines into the prism shown.



a. Make a sketch of a pattern for a triangular prism. Label each line segment with a length that will make it possible to fold the pattern into the triangular prism.

b. Make a sketch of a pattern for a cylinder. Label each line segment and diameter in your pattern with a length that will make it possible to create the cylinder from the pattern.

Scoring Guide

Score	Description
4	Student shows comprehensive sense of spatial relationships by making accurate sketches of patterns for two three-dimensional geometric figures and labeling the lengths of edges appropriately.
3	Student shows good sense of spatial relationships by making accurate sketches of patterns for two three-dimensional geometric figures and labeling the lengths of edges. One or two significant measures may be omitted.
2	Student shows partial sense of spatial relationships by inconsistently making sketches of patterns for two three-dimensional geometric figures or inconsistently labeling the lengths of edges.
1	Student shows limited sense of spatial relationships by making major errors in sketches and labeling.
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response.

Open Response Question 12

An eighth-grade class will perform the first **four** acts in the annual talent show. Every student is in exactly one of the four acts. The order in which the acts will be presented is to be decided by a drawing so that each act has an equal chance of being drawn.

a. Chantal is a member of the eighth-grade class. What is the probability that her act will be presented first?

b. Chantal's act was chosen to be presented first. Make a tree diagram, chart, or list showing all the possible orders in which the **other three acts** could be presented. Use the letters A, B, and C to represent these three acts.

c. Rory, Jesse, and Chantal are all members of the eighth-grade class who will each perform an act. What is the probability that Rory's act will immediately follow Jesse's? Explain how you found your answer.

Scoring Guide

Score	Description
4	The response demonstrates comprehensive understanding of the concepts of probability and basic combinatorics by accurately describing outcomes and events and determining the probability of those events.
3	The response demonstrates general understanding of the concepts of probability and basic combinatorics by describing outcomes and events and determining the probability of those events.

2	The response demonstrates basic understanding of the concepts of probability and basic combinatorics by describing outcomes and events and/or determining the probability of events.
1	The response demonstrates minimal understanding of the concepts of probability and basic combinatorics by describing outcomes and events and/or determining the probability of events.
0	The response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response.

Examples of Grade 10 English Composition Scoring Guides

2001 MCAS Sample Student Work
MCAS Student Work: Grade 10 English Language Arts Composition

NOTE: *The sample responses provided here are selections of actual student work from the MCAS administered in Spring 2001. In order to protect individual students' privacy, all names and references of a personal nature have been altered or removed. The responses have been recopied exactly as the student wrote them.*

Writing Assignment
A frequent theme in literature is the conflict between the individual and society.
From a work of literature you have read in or out of school, select a character who struggles with society. In a well-developed composition, identify the character and explain why this character's conflict with society is important.

Scoring Guide for Topic/Idea Development

View Score	Description
6 Points	• Rich topic/idea development • Careful and/or subtle organization • Effective/rich use of language
5 Points	• Full topic/idea development • Logical organization • Strong details • Appropriate use of language
4 Points	• Moderate topic/idea development and organization • Adequate, relevant details • Some variety in language
3 Points	• Rudimentary topic/idea development • Basic supporting details • Simplistic language
2 Points	• Limited or weak topic/idea development, organization, and/or details • Limited awareness of audience and/or task
1 Point	• Limited topic/idea development, organization, and/or details • Little or no awareness of audience and/or task
Blank	No response.

*Compositions were scored 1-6 on *Topic Development* and 1-4 on *Conventions*.

Scoring Guide for Standard English Conventions

View Score	Description
4 Points	• Control of sentence structure, grammar and usage, and mechanics (length and complexity of essay provide opportunity for student to show control of standard English conventions)
3 Points	• Errors do not interfere with communication and/or • Few errors relative to length of essay or complexity of sentence structure, grammar and usage, and mechanics
2 Points	• Errors interfere somewhat with communication and/or • Too many errors relative to the length of the essay or complexity of sentence structure, grammar and usage, and mechanics
1 Point	• Errors seriously interfere with communication AND • Little control of sentence structure, grammar and usage, and mechanics
Blank	No response.

***Compositions were scored 1-6 on *Topic Development* and 1-4 on *Conventions*.**

Example of Grade 10 Language and Literature Scoring Guide

2001 MCAS Sample Student Work

MCAS Student Work: Grade 10 English Language Arts (Language and Literature)

NOTE: *The sample responses provided here are selections of actual student work from the MCAS administered in Spring 2001. In order to protect individual students' privacy, all names and references of a personal nature have been altered or removed. The responses have been recopied exactly as the student wrote them.*

Open Response Question 9

Mark Twain said, "Make your vocation your vacation." Explain how this quotation relates to this article. Use specific evidence from the article to support your answer.

Scoring Guide

Score	Description
4	Response provides an explanation of how Mark Twain's quotation relates to the article. The explanation demonstrates a complete understanding of the meaning of the quotation and the main point of the article, and the connection between them. Specific supporting evidence from the article is included in the answer.
3	Response provides an explanation of how Mark Twain's quotation relates to the article. The explanation demonstrates a general understanding of the meaning of the quotation and the main point of the article, and the connection between them. Relevant supporting evidence from the article is included in the answer, but the evidence lacks some development or specificity.
2	Response provides an explanation of how Mark Twain's quotation relates to the article. The explanation demonstrates a partial understanding of the connection between the quotation and the main point of the article and includes limited or partially correct supporting evidence from the article.
1	Response makes a brief or vague but relevant statement about the quotation an/or the article.
0	Response is totally incorrect or irrelevant.
Blank	No response.

Examples of Grade 10 Mathematics Scoring Guides

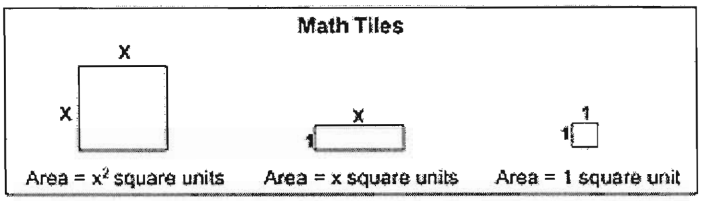
2001 MCAS Sample Student Work

MCAS Student Work: Grade 10 Mathematics

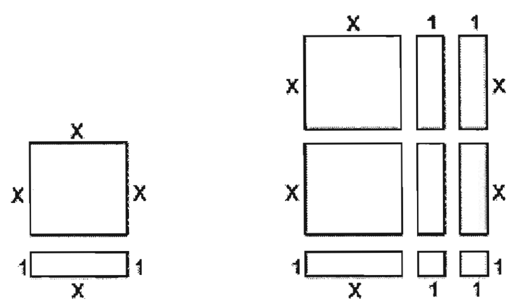
NOTE: *The sample responses provided here are selections of actual student work from the MCAS administered in Spring 2001. In order to protect individual students' privacy, all names and references of a personal nature have been altered or removed. The responses have been recopied exactly as the student wrote them.*

Open Response Question 13

Use the figure below to answer question 13.



In the figures below, math tiles were used to build rectangular arrays to represent each of the quadratic expressions.



$x(x + 1)$ or $x^2 + x$ $(x + 2)(2x + 1)$ or $2x^2 + 5x + 2$

1. Show how to build rectangular arrays, if possible, for each of the following expressions using the three math tiles.
   $2x^2 + 3x + 1$
   $3x^2 + 2x$
   $3x^2 + 6x + 5$

2. How can you determine if a rectangular array can be built for an expression?

Scoring Guide

Score	Description
4	The response demonstrates a thorough understanding of and facility with factoring polynomial expressions.
3	The response demonstrates a general understanding of and facility with factoring polynomial expressions.
2	The response demonstrates a partial understanding of factoring polynomial expressions.
1	The response demonstrates a minimal understanding of factoring polynomial expressions.
0	The response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response.

Open Response Question 16

When Elena works on Saturdays, she buys a salad and juice for lunch. There are two take-out restaurants near where she works. The prices in the two restaurants are given below.

Hector's To Go		Tammy's Take-Out	
Juice	$2.00 per bottle	Juice	$1.00 per bottle

Salad bar 25¢ per ounce	Salad bar 50¢ per ounce

a. How many ounces of salad, together with a bottle of juice, can Elena buy at Hector's To-Go for $4.50?

b. Write an equation that shows the cost, C, of Elena's lunch at Hector's To-Go if she buys a bottle of juice and n ounces of salad.

c. On the grid in your Student Answer Booklet, graph the equation you wrote in part b.

- Use the horizontal axis for the number of ounces, with each increment representing one ounce.
- Use the vertical axis for cost, with each increment representing 50¢.

d. What are the different amounts of salad that Elena can buy so her complete lunch is less expensive at Tammy's Take-Out than at Hector's To-Go?
Remember that Elena always buys a bottle of juice with her salad. Show or explain how you found your answer.

Scoring Guide

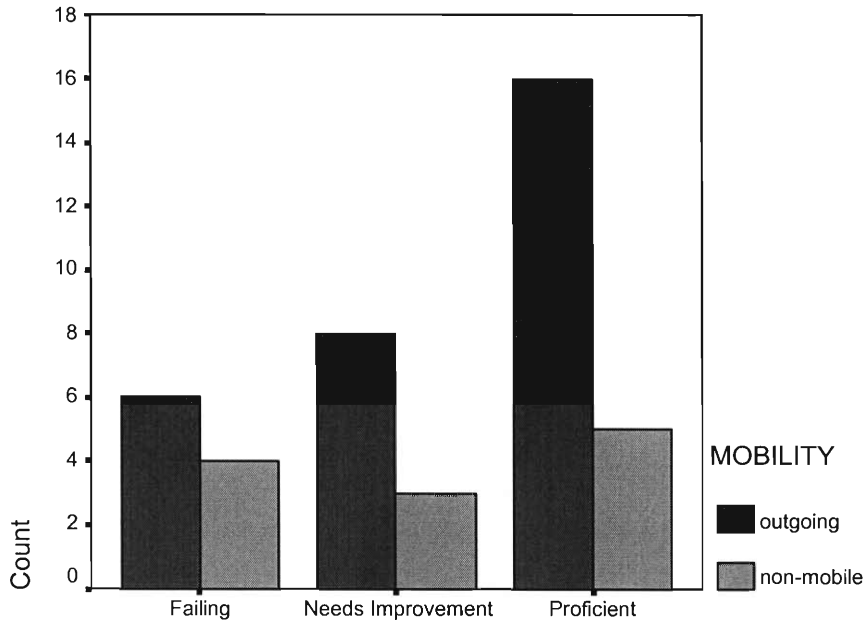
Score	Description
4	Response shows comprehensive understanding of systems of linear equations in two variables by correctly analyzing linear situations algebraically and graphically, and by using and explaining correct methods for comparing such relationships.
3	Response shows general understanding of systems of linear equations by analyzing situations algebraically or graphically, and by using and/or explaining correct methods for comparing such relationships.
2	Response shows basic understanding of how to analyze linear relationships algebraically or graphically.
1	Response shows minimal understanding linear relationships.
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response.

Appendix H

Analysis of Individual Schools

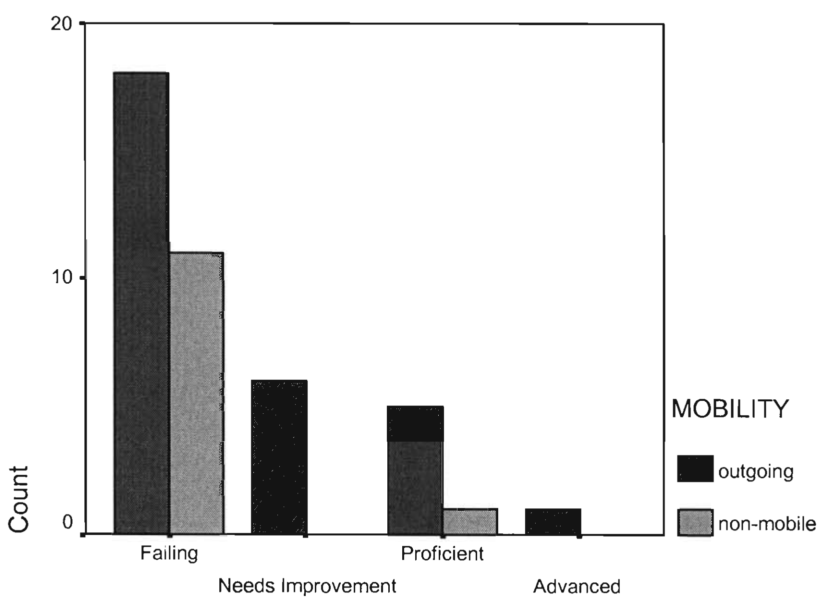
Appendix H
Accelerated Learning Lab

English98



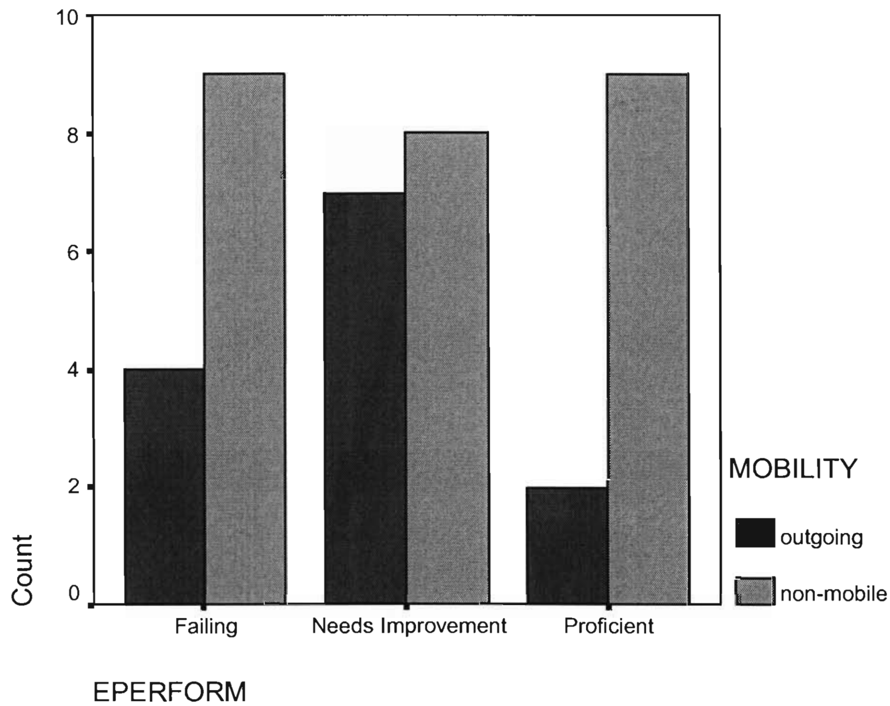
Cohort 1 ELA 8th

Math98

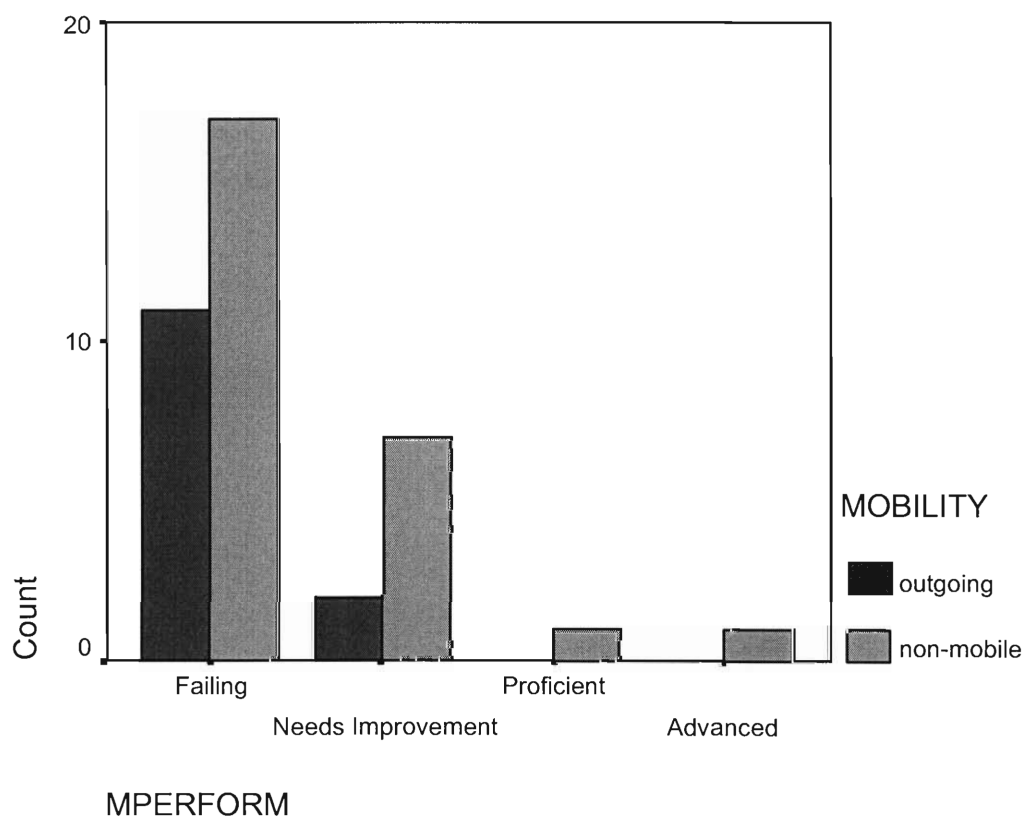


Cohort 1 MATH 8th

English99


10
8
6
4
2
0
Count
Failing
Needs Improvement
Proficient
EPERFORM
MOBILITY
outgoing
non-mobile

English99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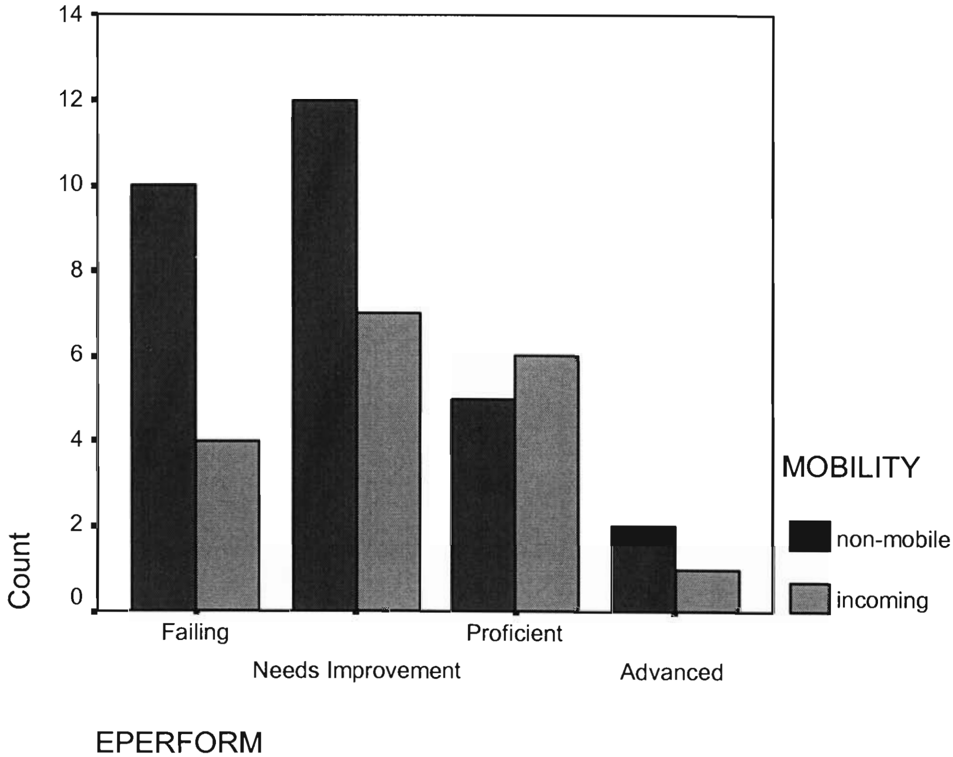
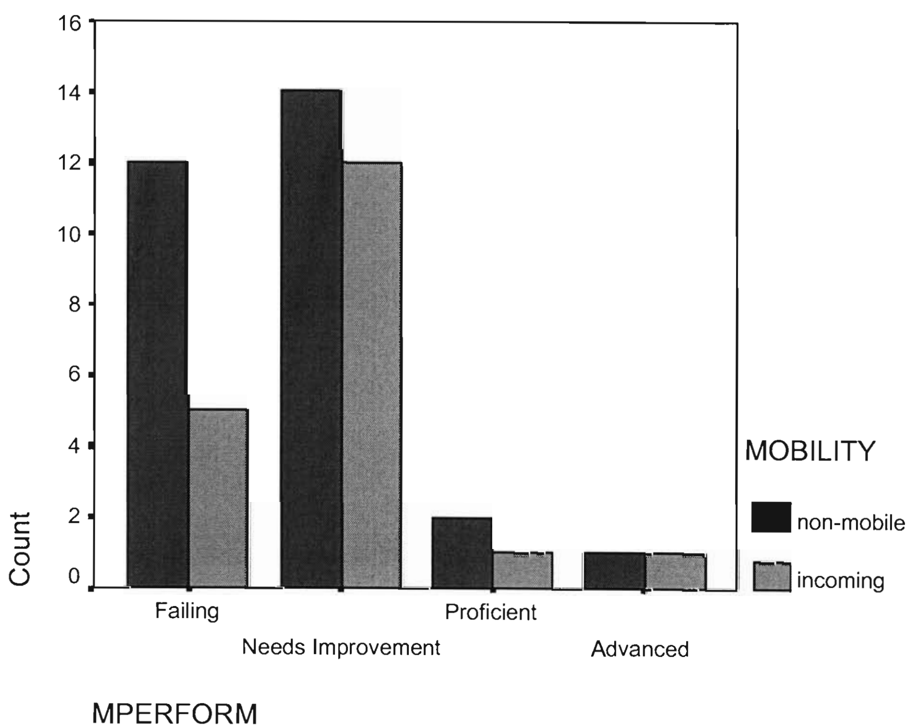
10
0
Count
Failing
Needs Improvement
Proficient
Advanced
MPERFORM
MOBILITY
outgoing
non-mobile

English01

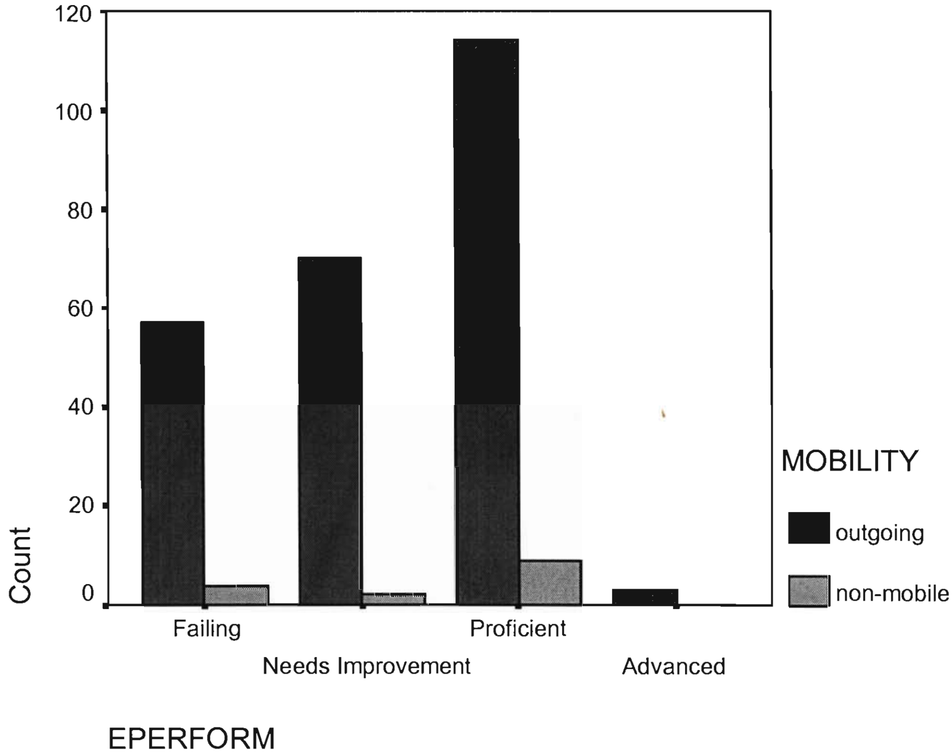


Math01

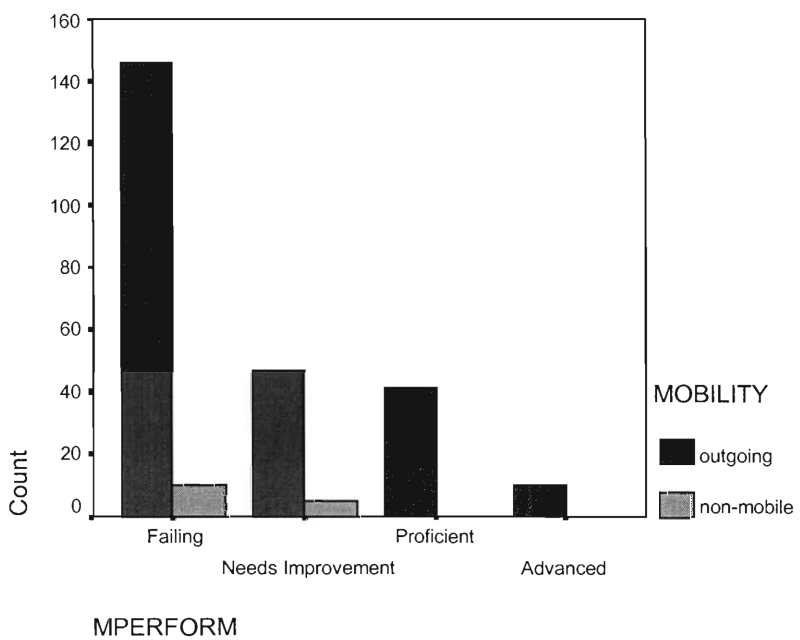


Burncoat Middle School

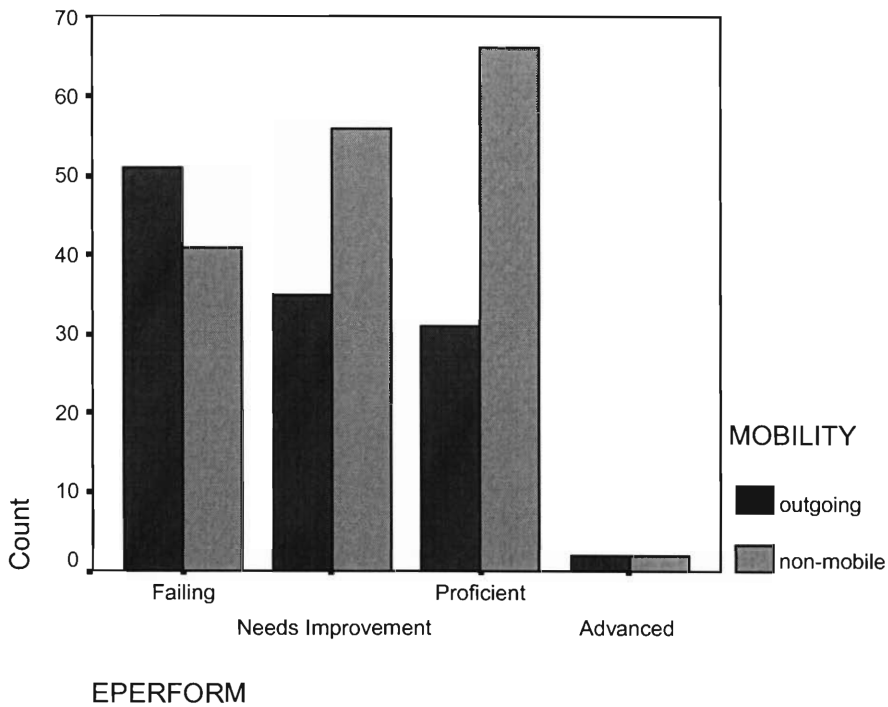
English98



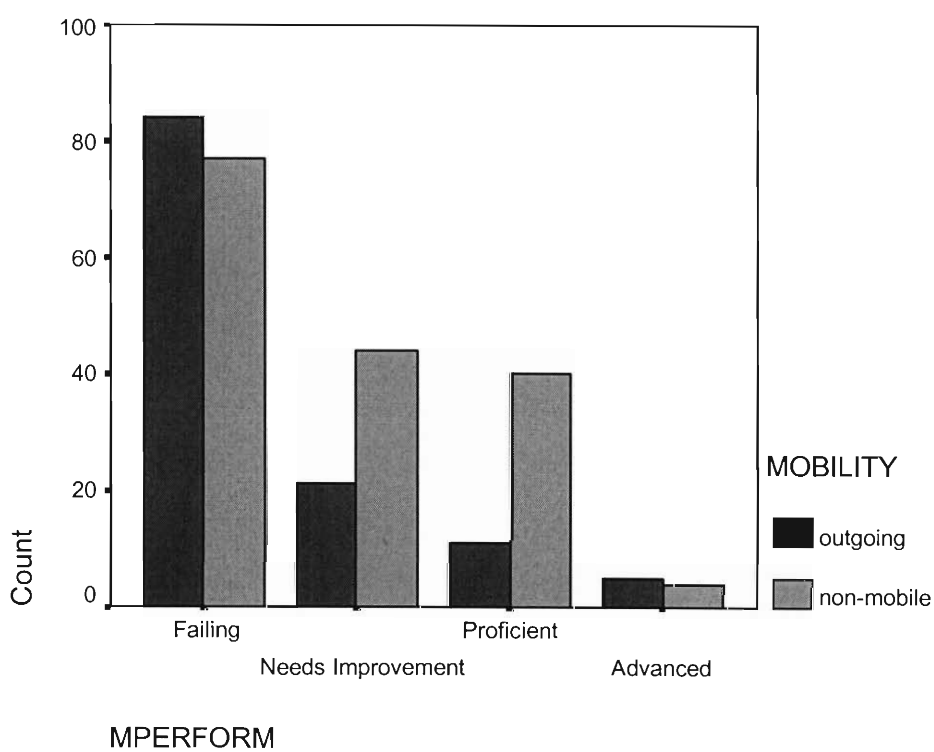
Math98



English99

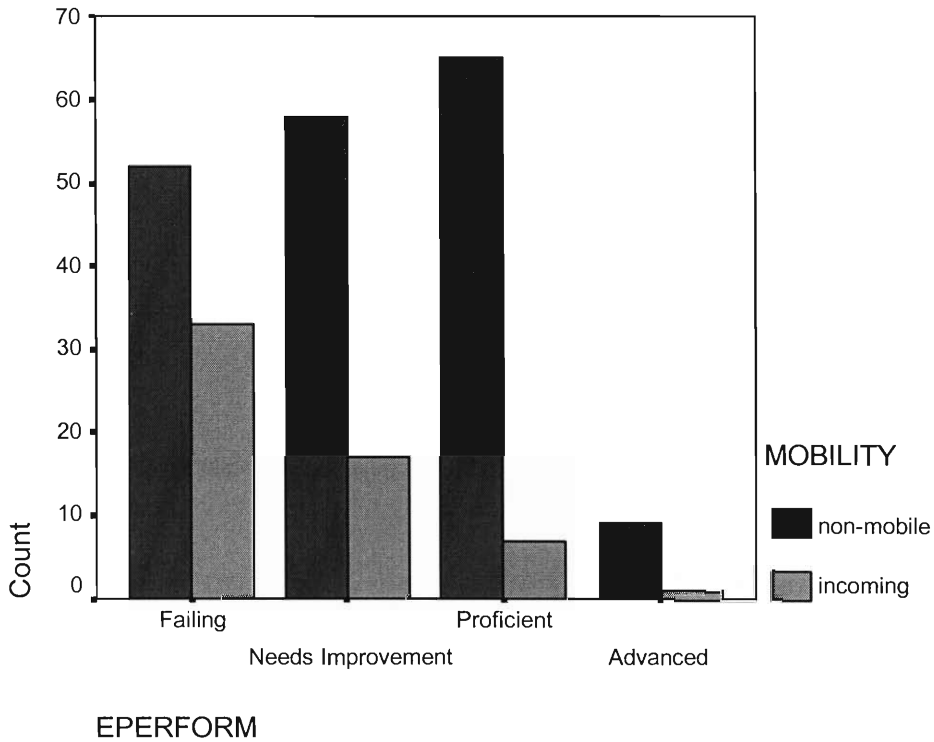


Math99

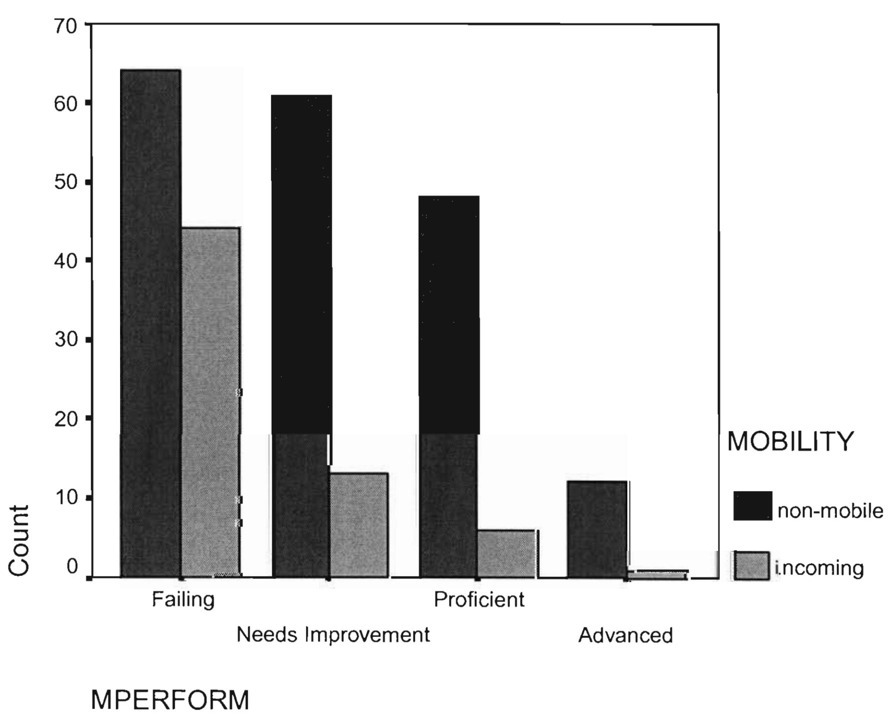


Burncoat High

English 01

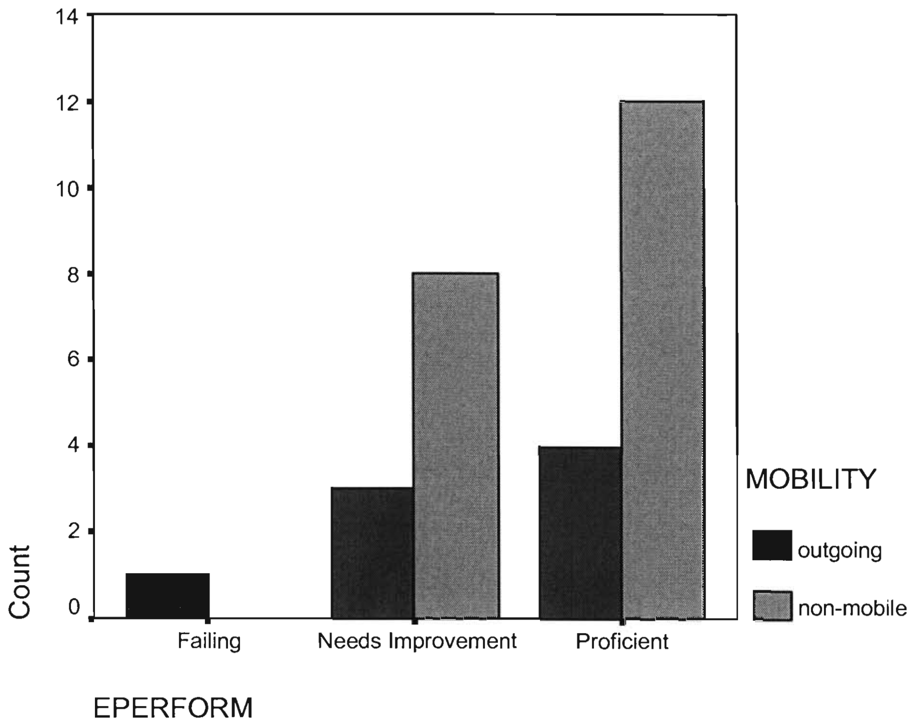


Math01



Doherty Memorial

English98



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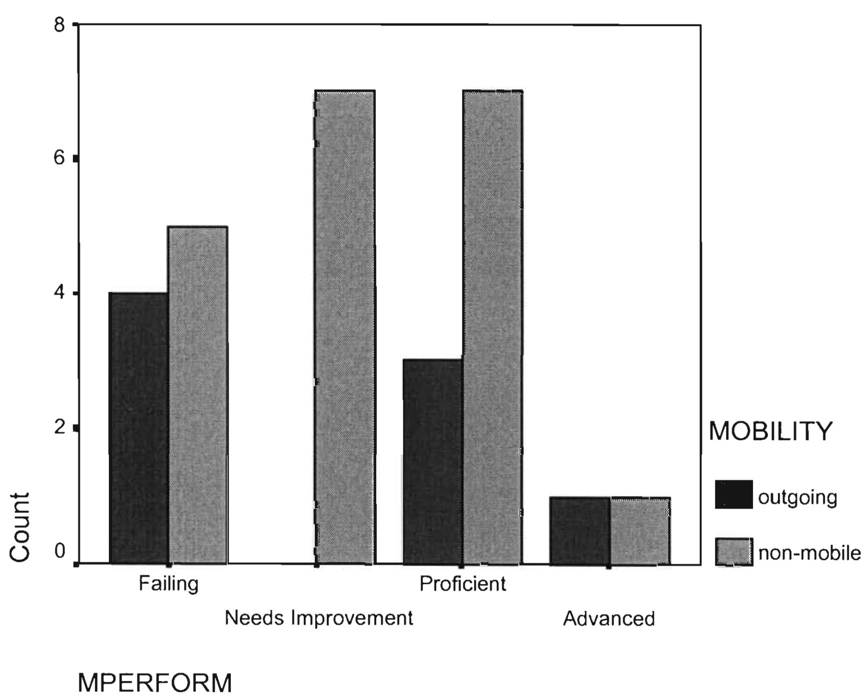
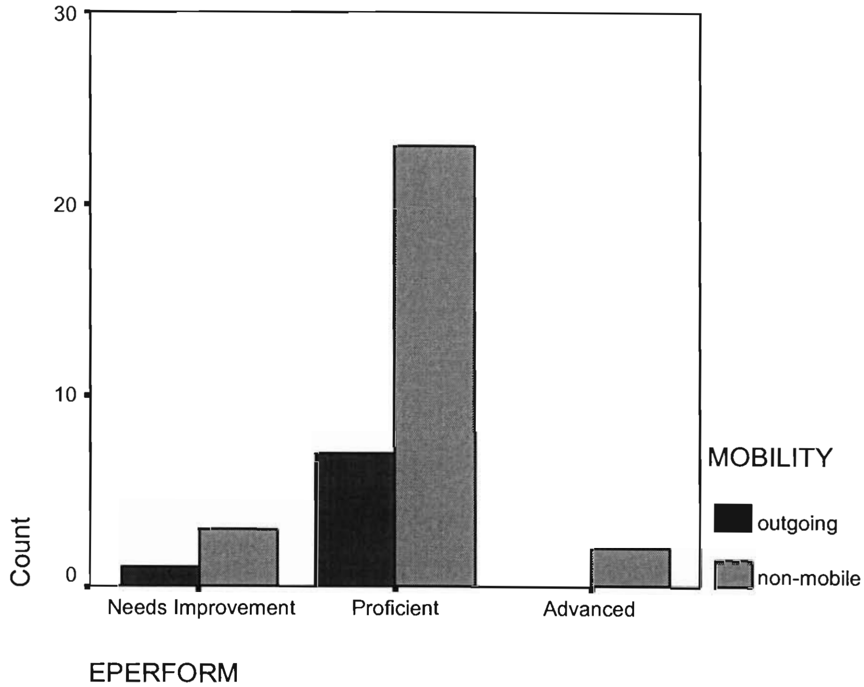


English99



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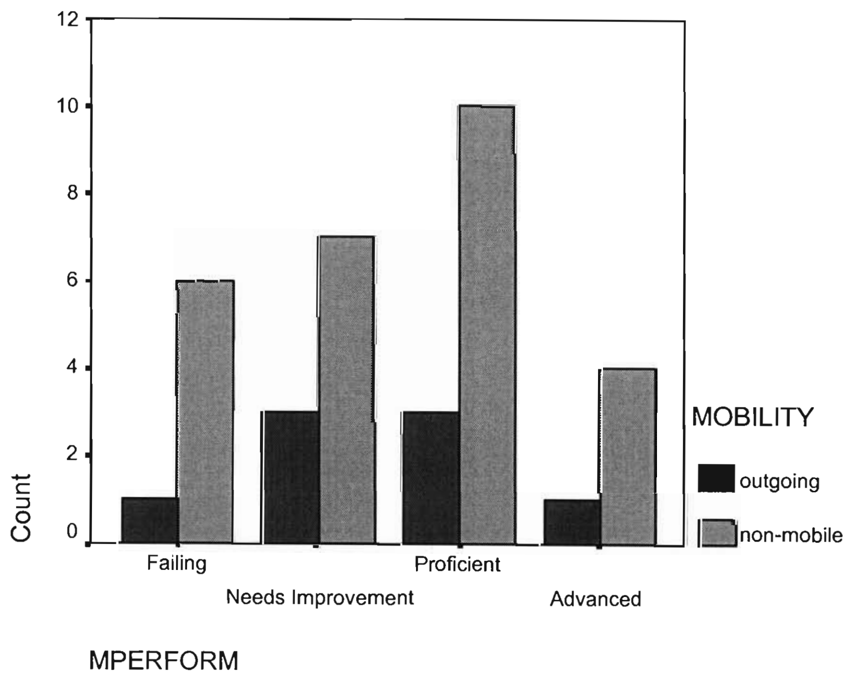
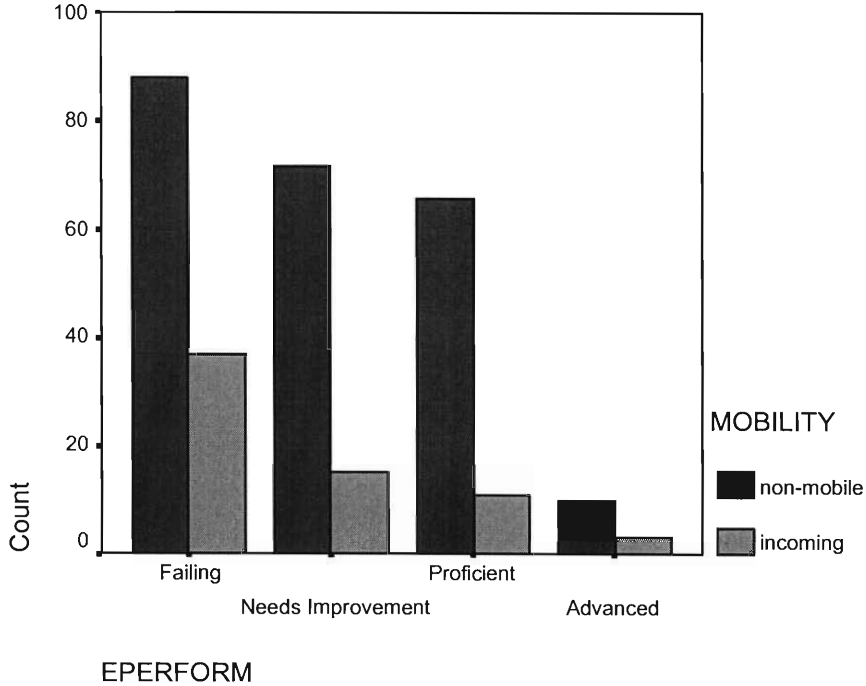
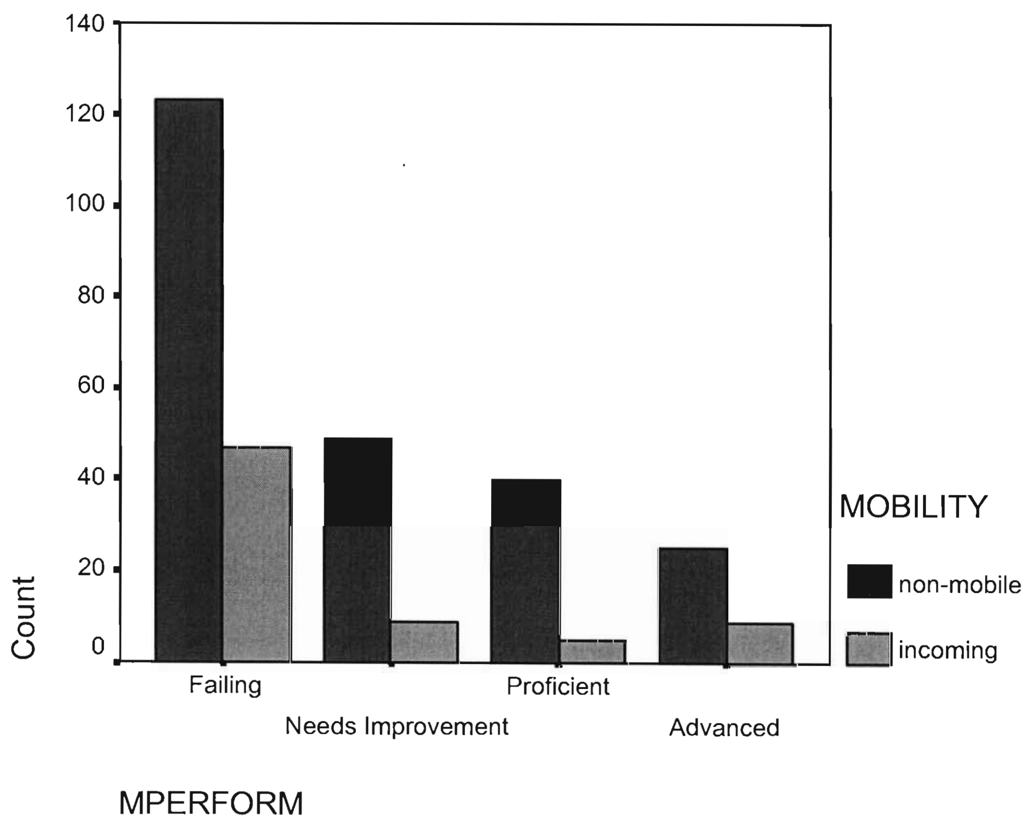


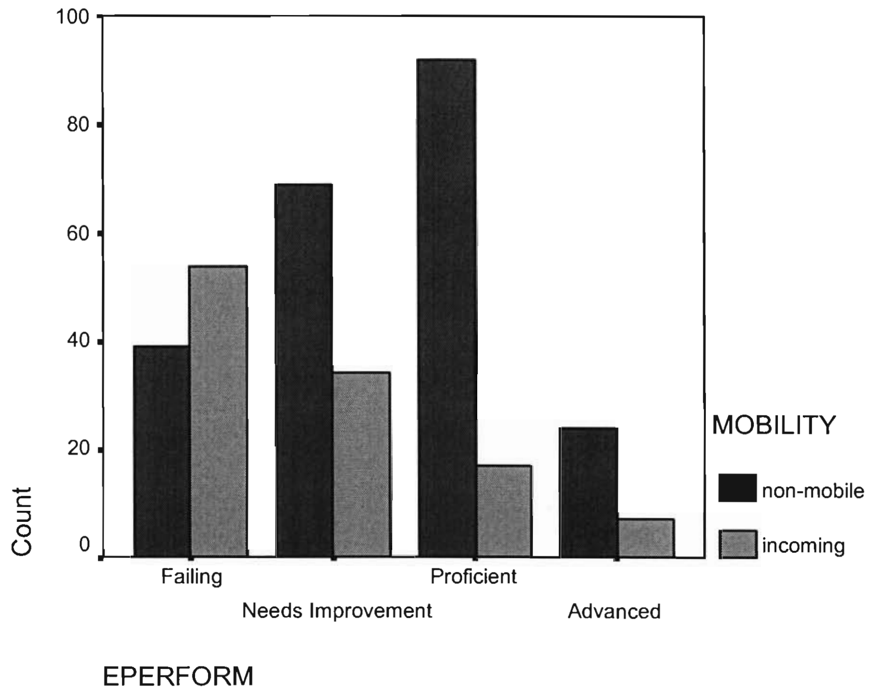
English00



Math00



English01



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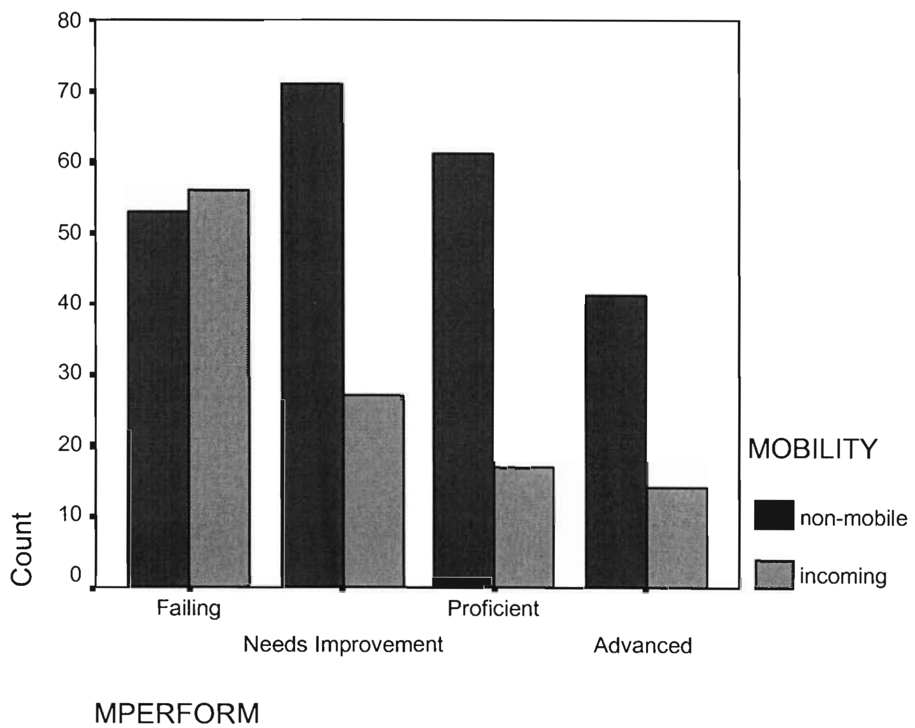
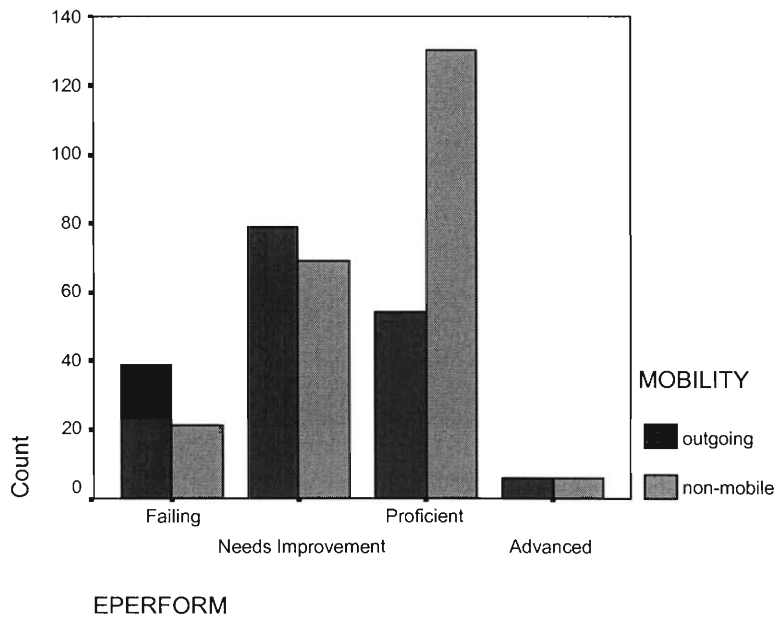
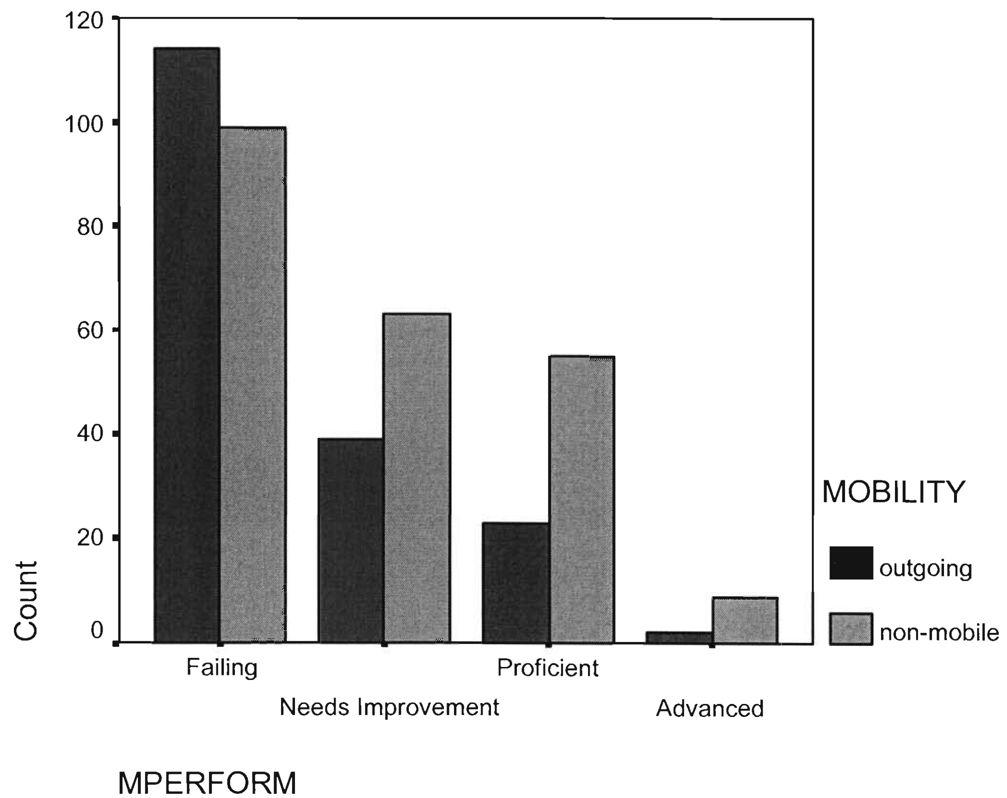


Forest Grove

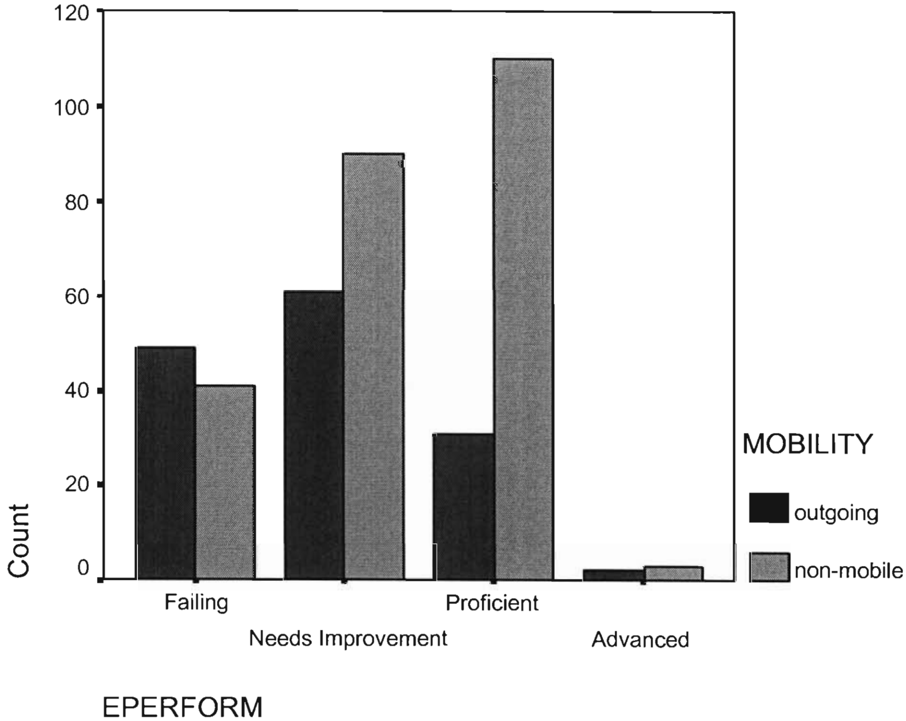
English98



Math98



English99



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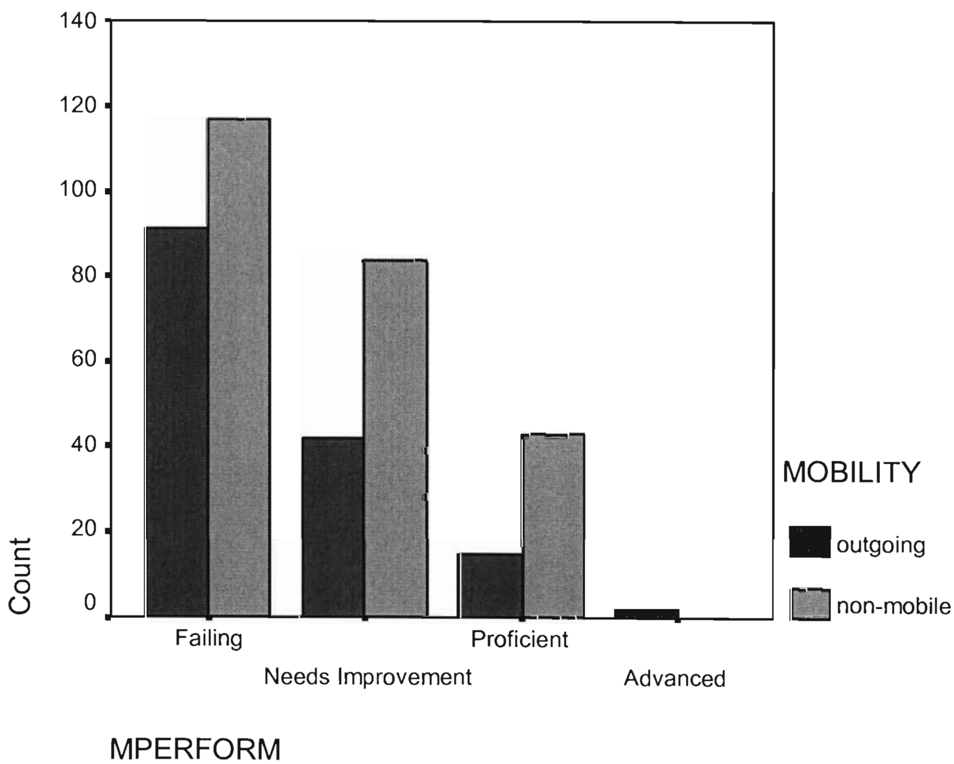
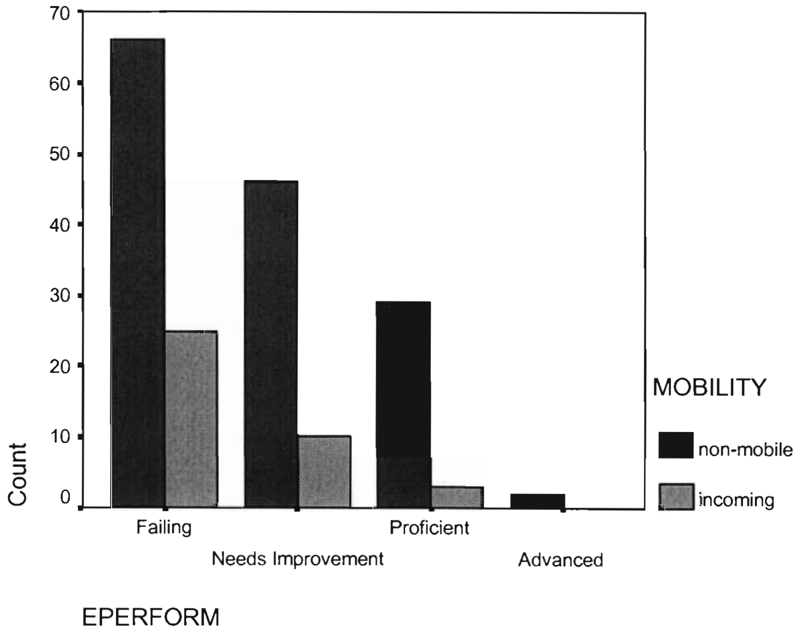


North High

English00



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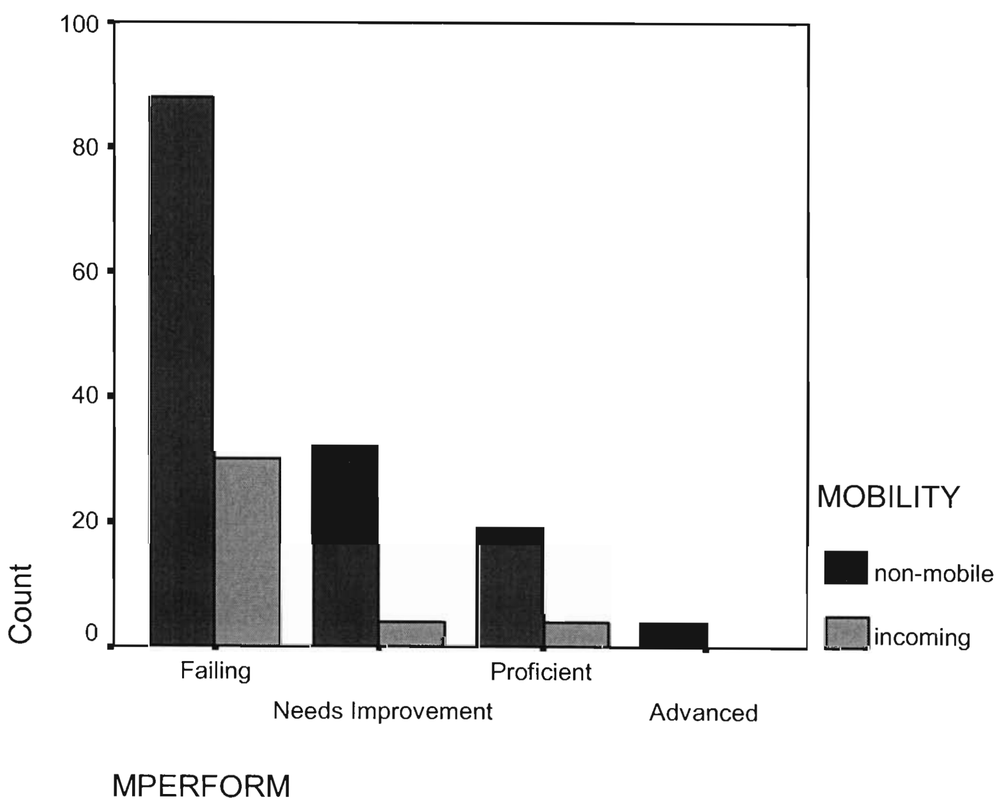
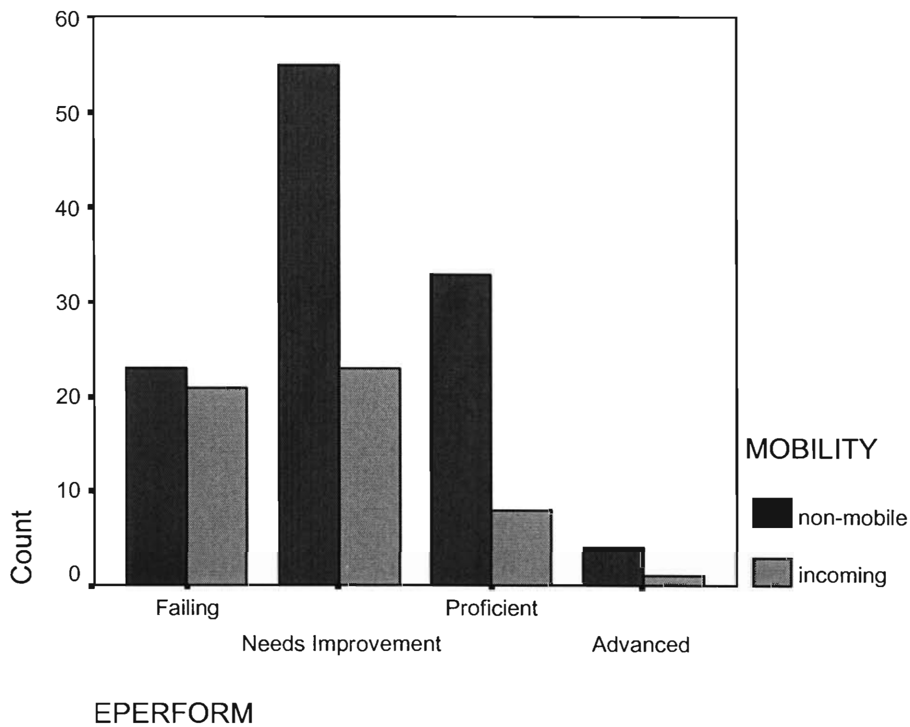
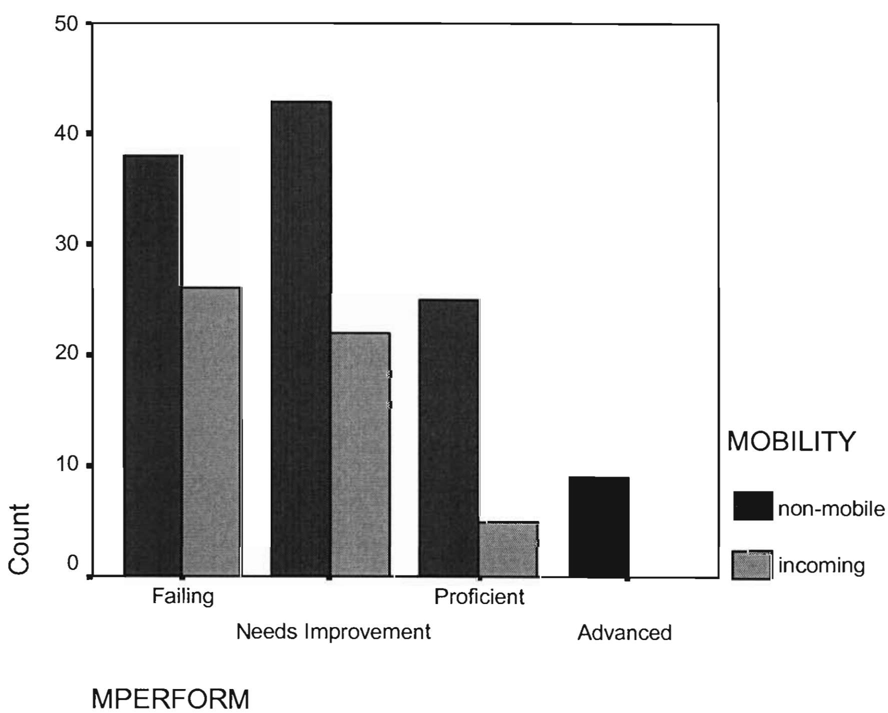


English01

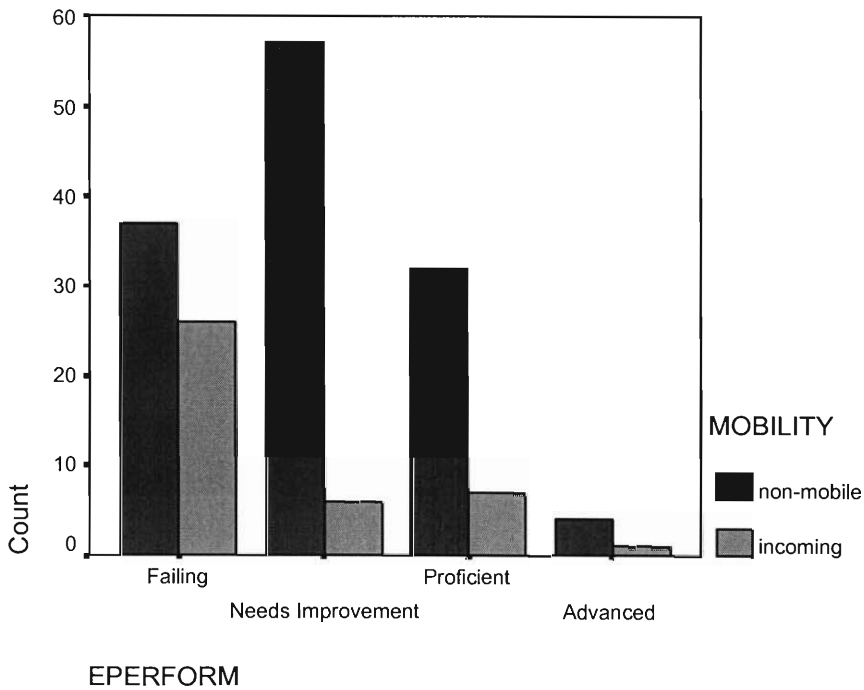


Math01

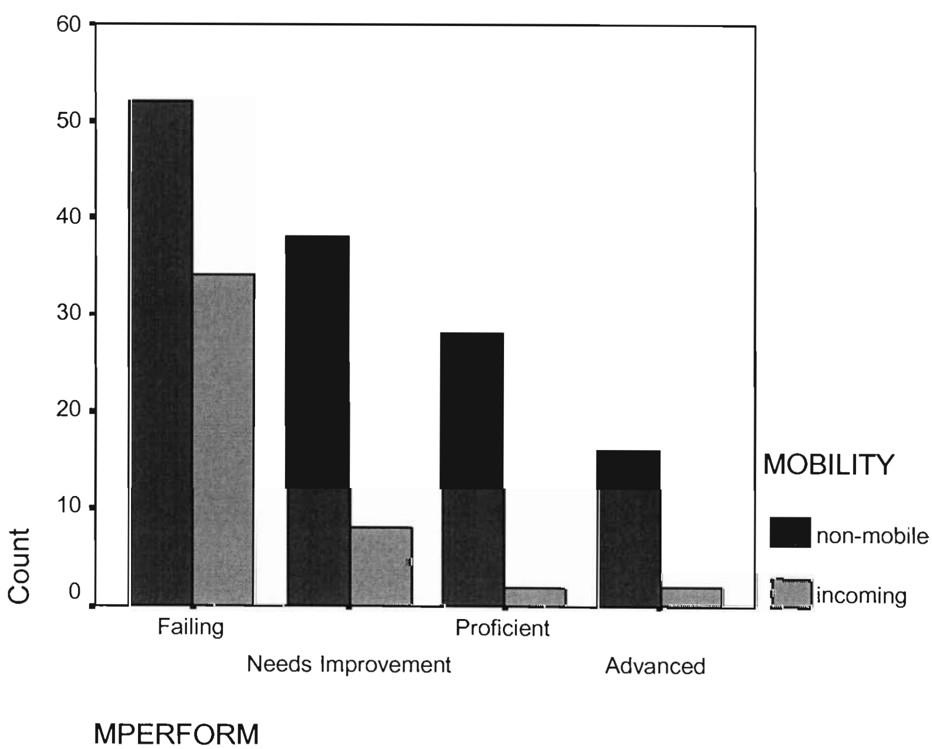


South High

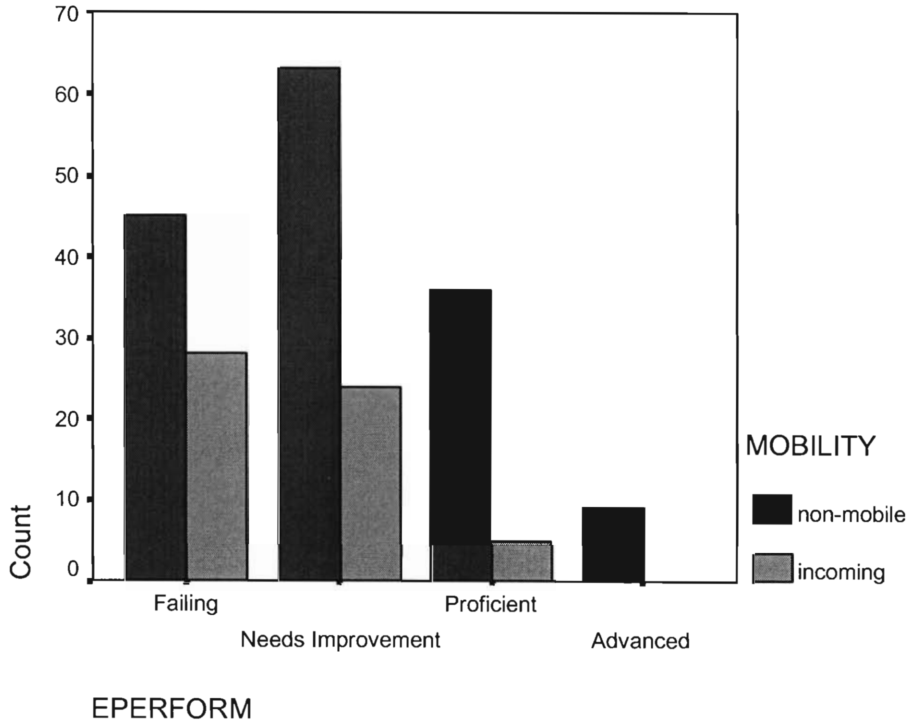
English00



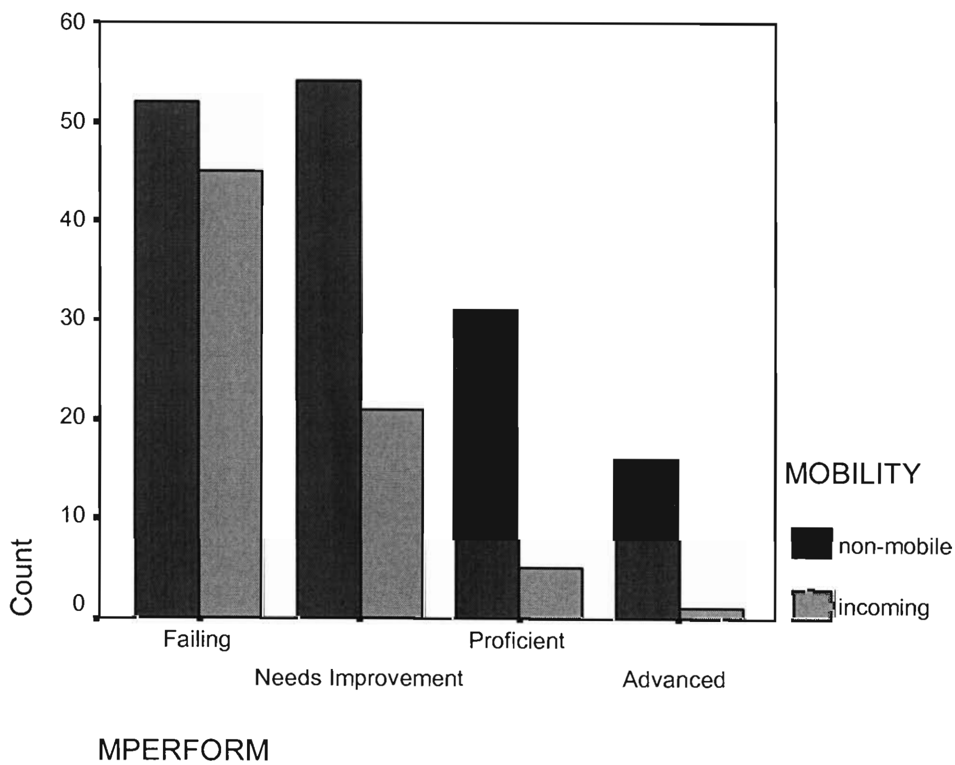
Math00



English01

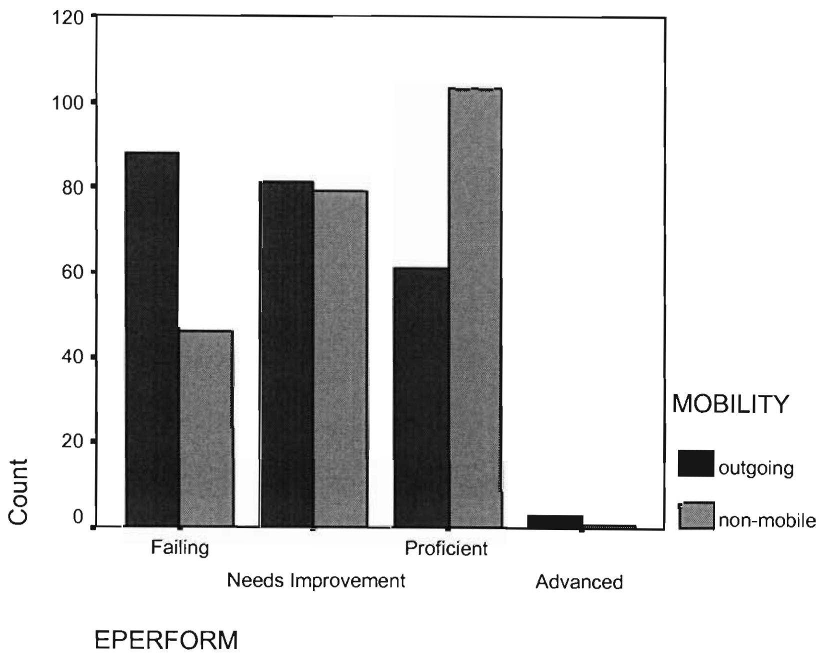


Math01

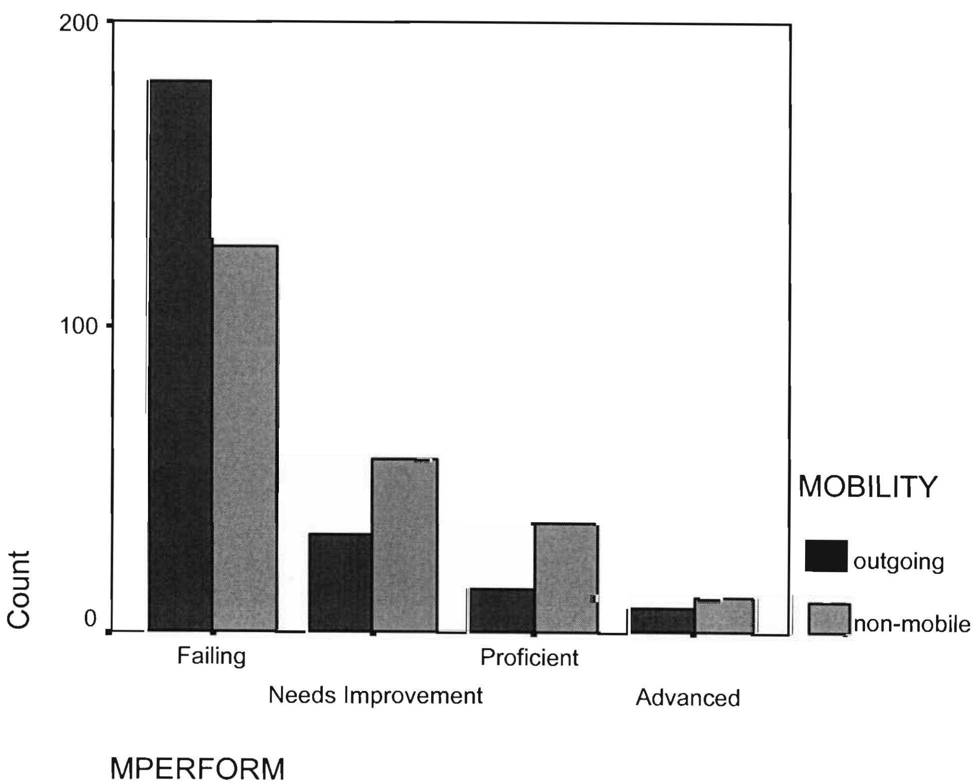


Sullivan Middle

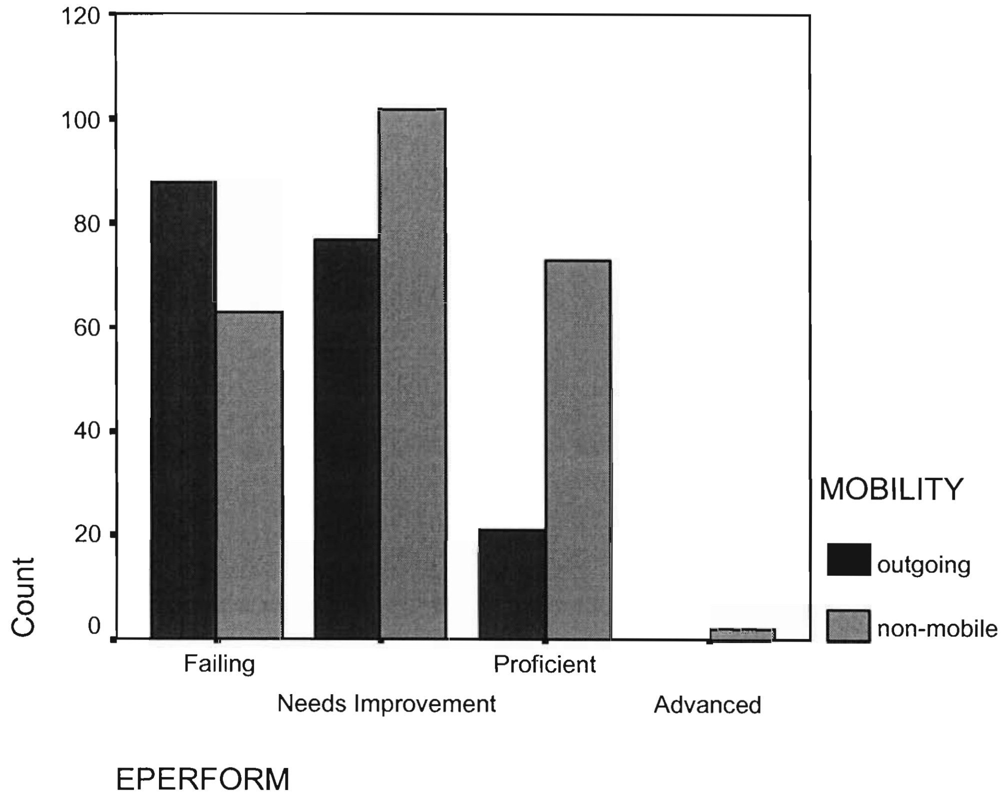
English98



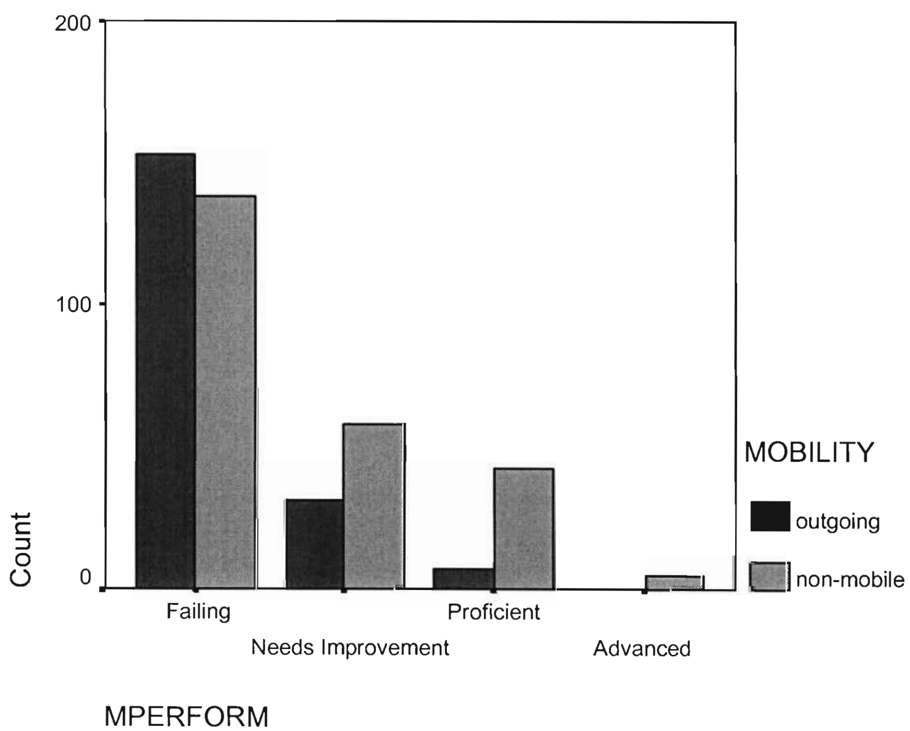
Math98



English99

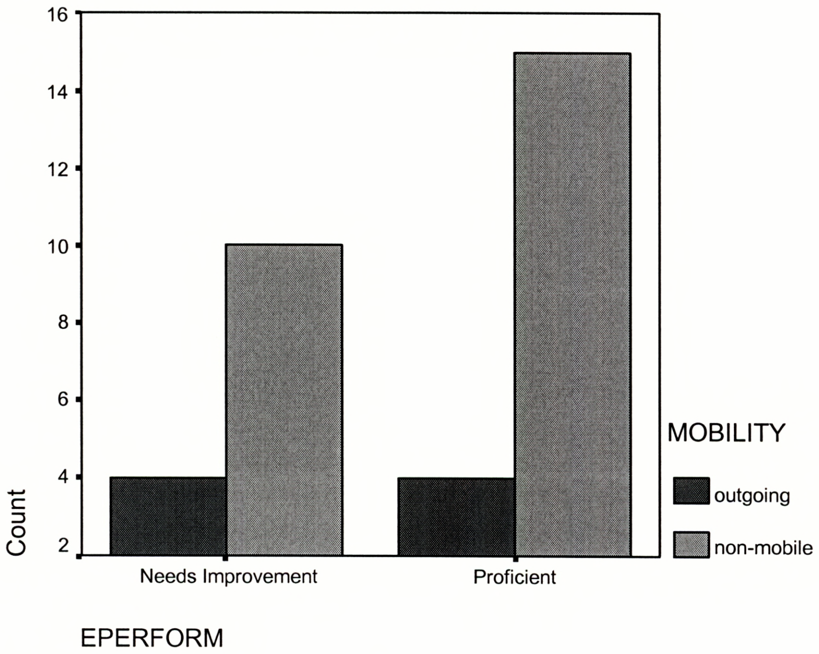


Math99

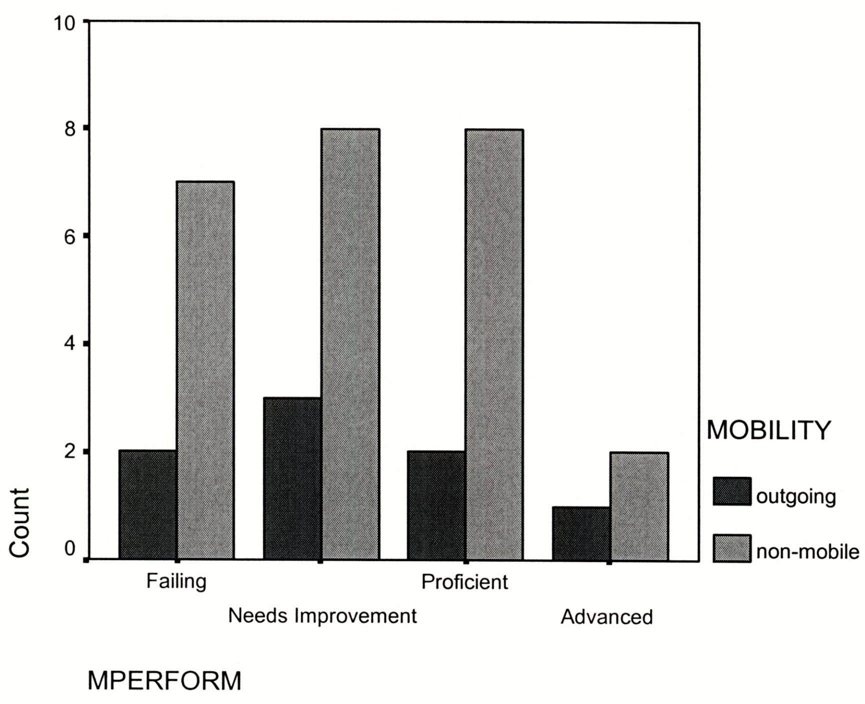


University Park

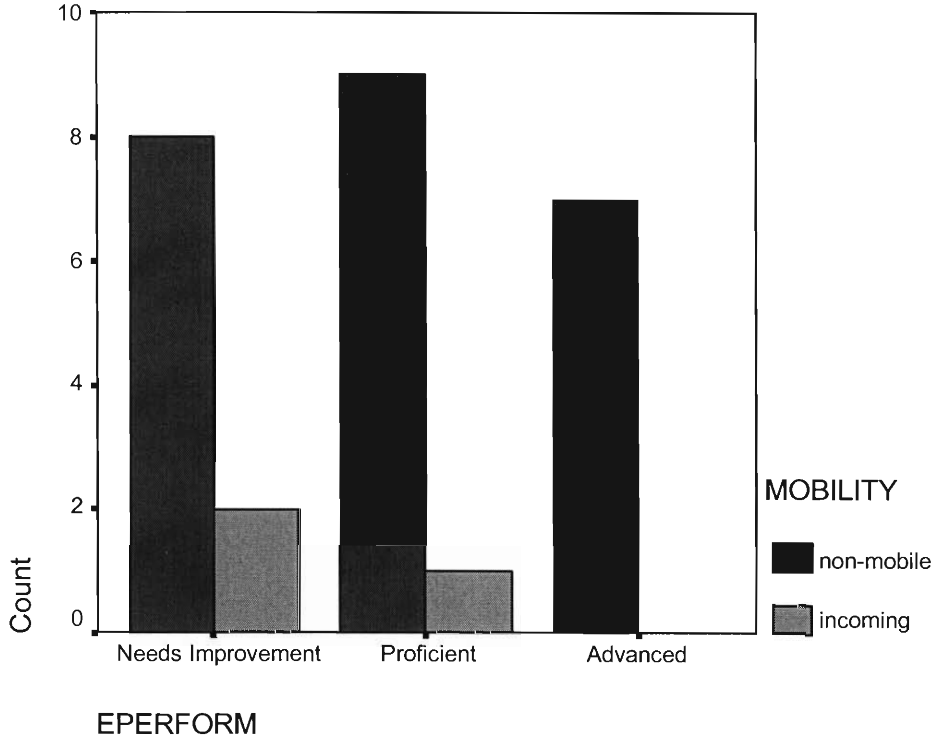
English99



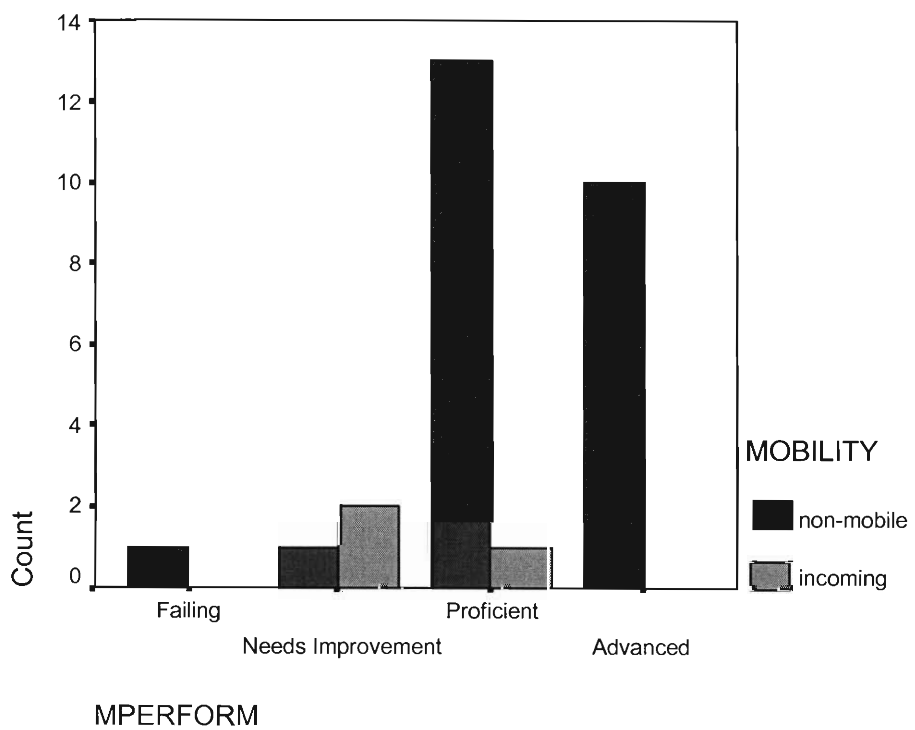
Math99



English01

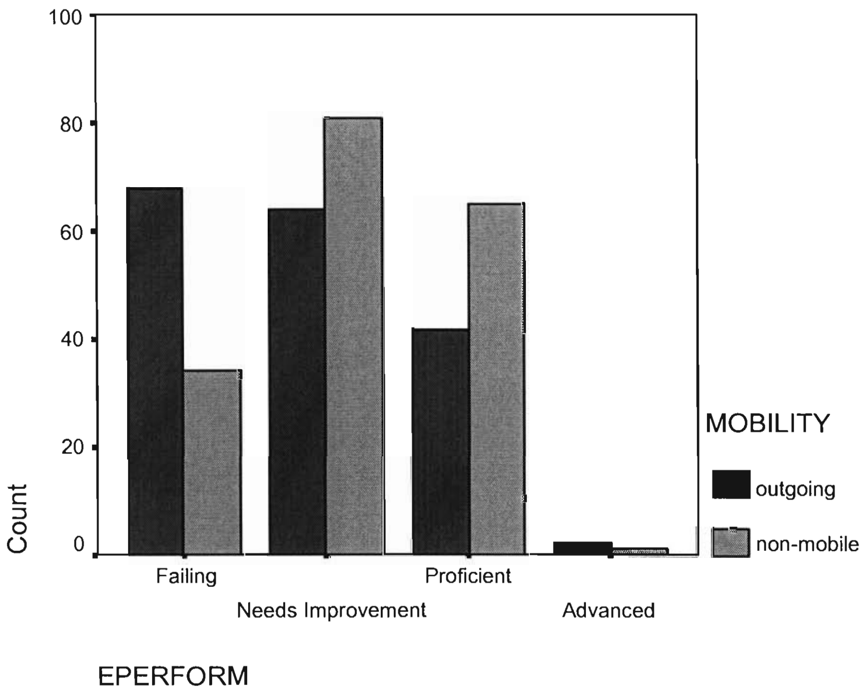


Math01

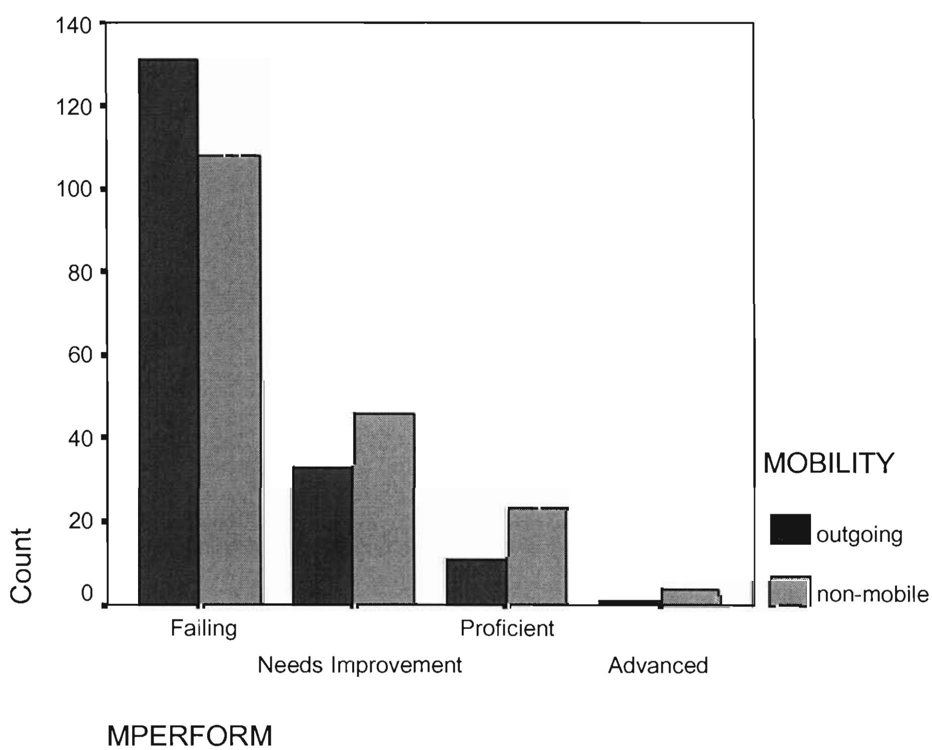


Worcester East

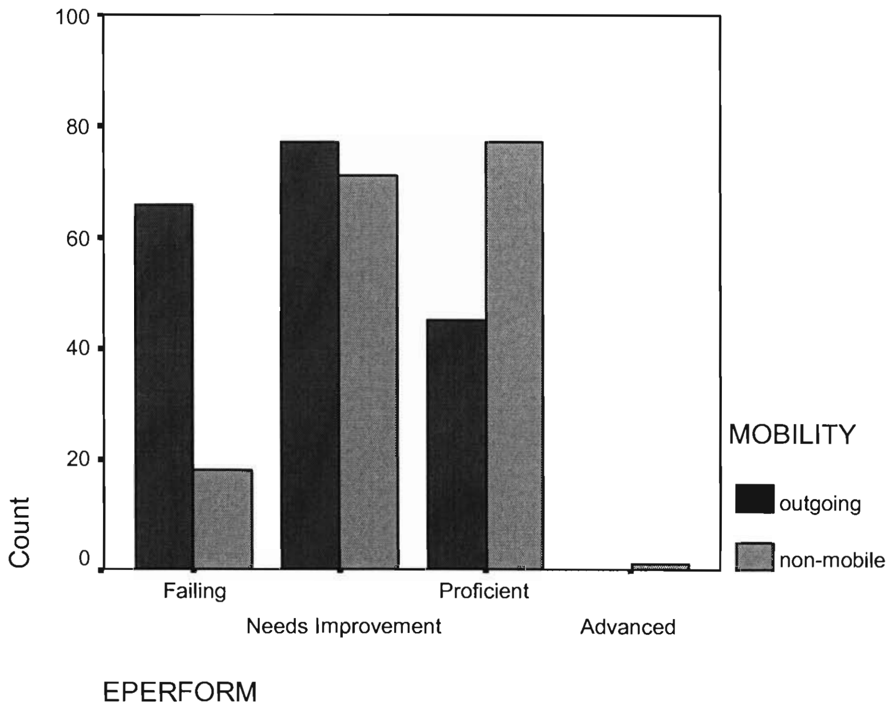
English98



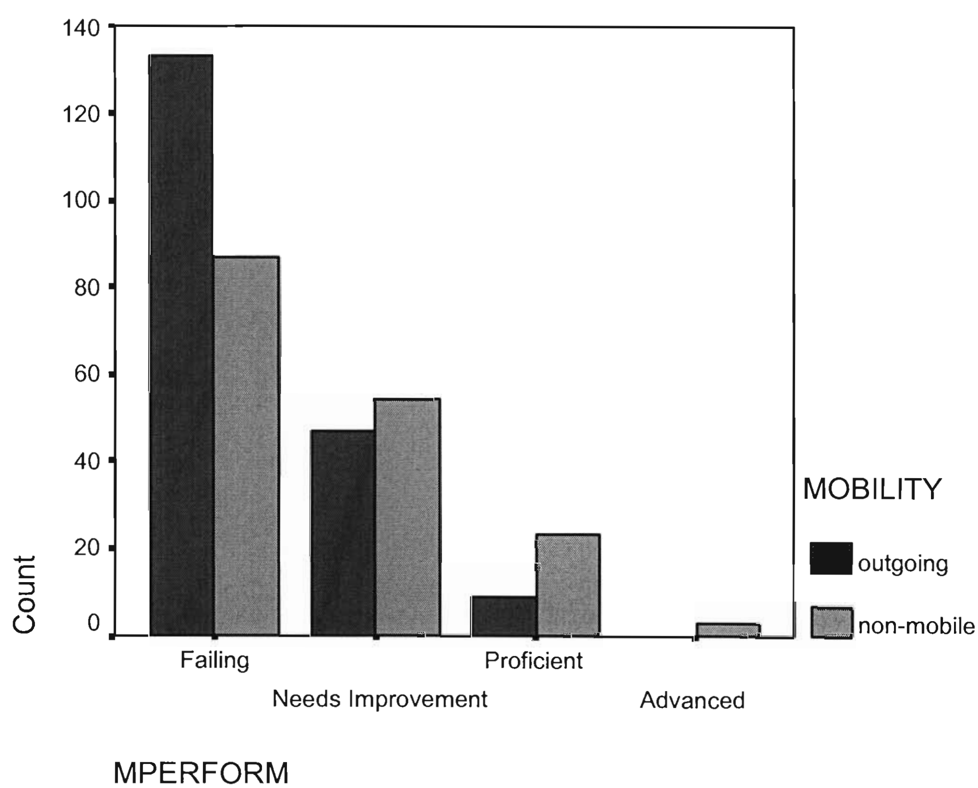
Math98



English99

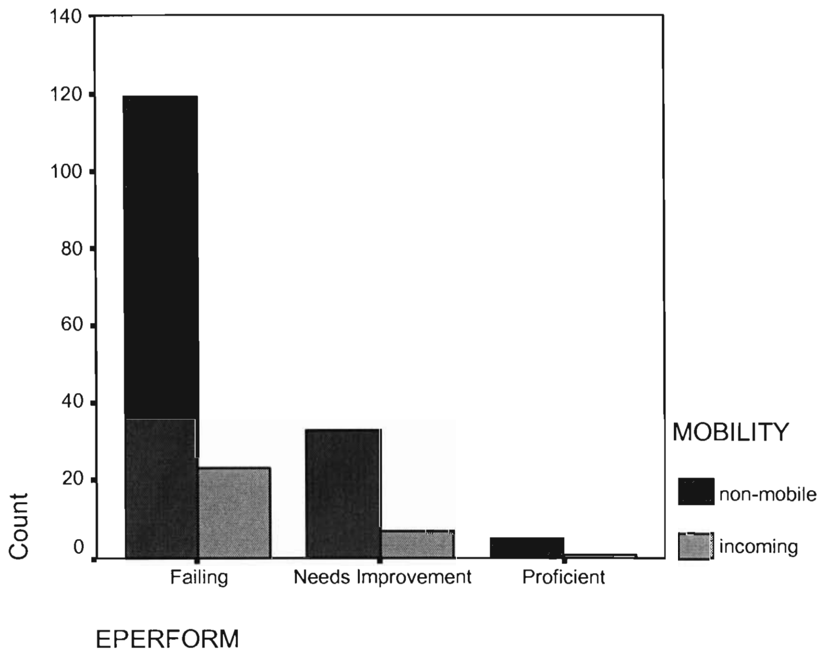


Math99

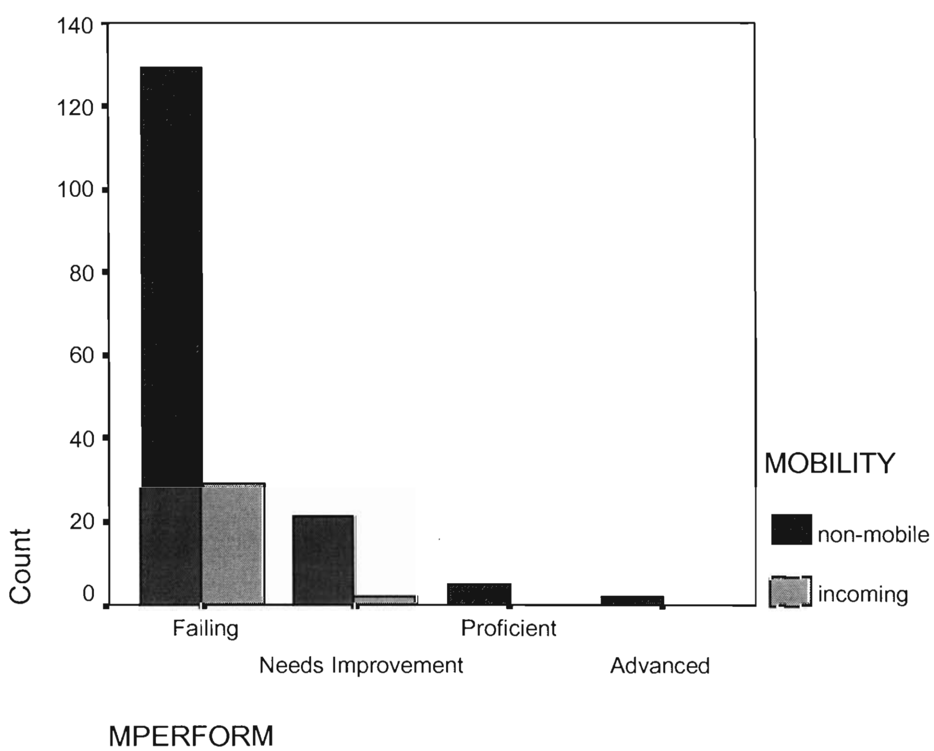


Worcester Vocational

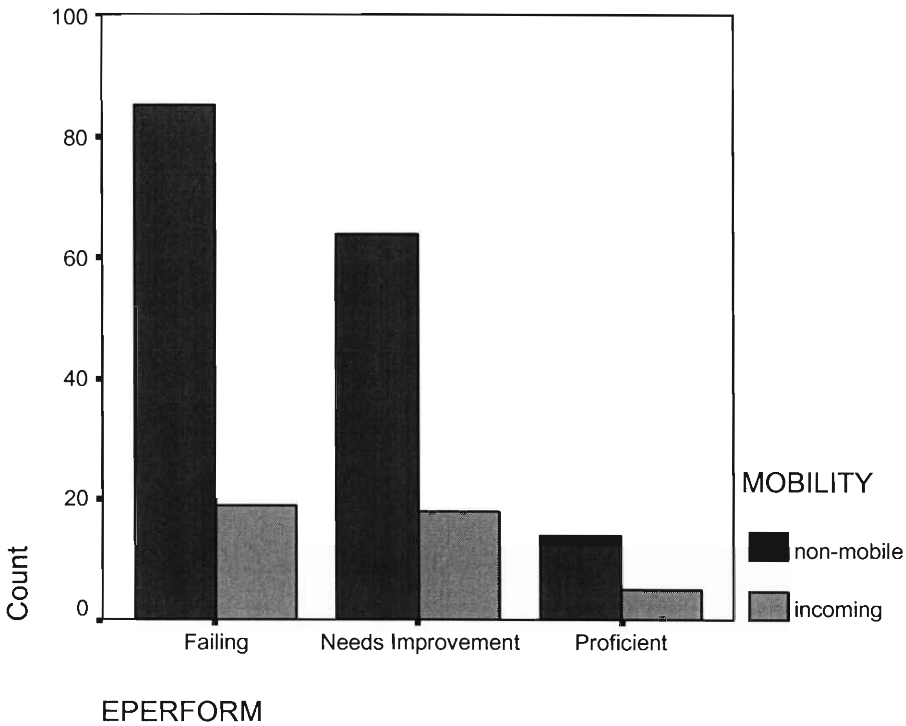
English00



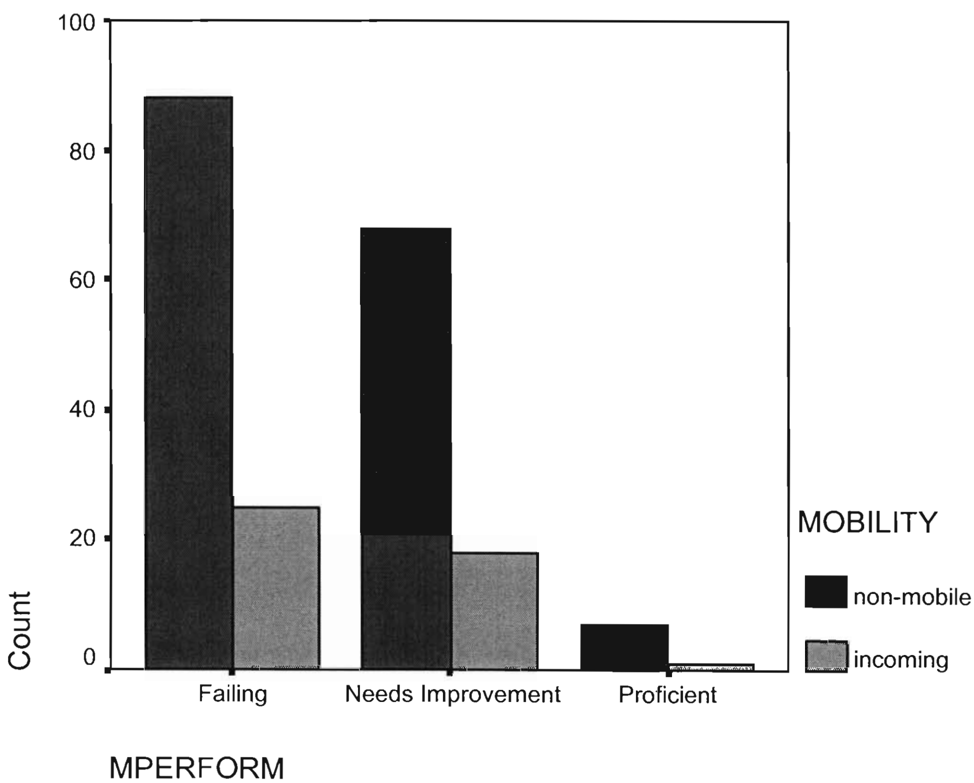
Math00



English01



Math01



Appendix I

Detailed Linear Regression

Appendix I

Regression for english00

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	GENDER, math98, eng98[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: eng00

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.747[a]	.558	.556	12.667

a. Predictors: (Constant), GENDER, math98, eng98

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	133808.0	3	44602.665	277.962	.000[a]
	Residual	106066.1	661	160.463		
	Total	239874.1	664			

a. Predictors: (Constant), GENDER, math98, eng98

b. Dependent Variable: eng00

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.086	9.070		.561	.575
	eng98	.627	.050	.453	12.596	.000
	math98	.342	.035	.345	9.784	.000
	GENDER	-3.876	1.029	-.102	-3.766	.000

a. Dependent Variable: eng00

Regression for math00

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	math98, eng98[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: math00

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.773[a]	.598	.597	13.661

a. Predictors: (Constant), math98, eng98

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	185218.2	2	92609.114	496.270	.000[a]
	Residual	124655.7	668	186.610		
	Total	309874.0	670			

a. Predictors: (Constant), math98, eng98

b. Dependent Variable: math00

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.767	8.956		.867	.386
	eng98	.162	.051	.105	3.207	.001
	math98	.786	.037	.700	21.445	.000

a. Dependent Variable: math00

Frequencies

Statistics

		eng98	math98	GENDER
N	Valid	683	683	681
	Missing	14	14	16
Mean		235.04	221.03	1.51

Regression for math01

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	math99[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: math01

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.410[a]	.168	.167	32.555

a. Predictors: (Constant), math99

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	191690.1	1	191690.148	180.873	.000[a]
	Residual	948525.4	895	1059.805		
	Total	1140216	896			

a. Predictors: (Constant), math99

b. Dependent Variable: math01

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	45.032	13.530		3.328	.001
	math99	.818	.061	.410	13.449	.000

a. Dependent Variable: math01

Regression for eng01

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	eng99[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: eng01

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.378[a]	.143	.142	35.008

a. Predictors: (Constant), eng99

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	182173.6	1	182173.571	148.641	.000[a]
	Residual	1094455	893	1225.594		
	Total	1276629	894			

a. Predictors: (Constant), eng99

b. Dependent Variable: eng01

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-12.408	19.676		-.631	.528
	eng99	1.024	.084	.378	12.192	.000

a. Dependent Variable: eng01

Appendix J

Sample Questionnaire for Principals

Worcester Polytechnic Institute
Ezra Moses
Sumeet Chani
Conway Chuong

Central Administration Building

20 Irving St. Worcester, MA

To whom it may concern:

We are WPI students currently working on our Interqualifying Project (IQP), one of three major projects required for graduation from WPI. Our project involves a statistical study on the statewide MCAS test and how student mobility and other demographic factors affect MCAS scores in the Worcester Public School system. Attached is a list of students that we believe attended your school between the 1998 and 2001 academic years and have taken the MCAS. To help us better understand reasons for student mobility, we ask that you print and fill out the attached table, along with any other information on each student's mobility. Please fax this document to Dr. Mostue's office at the Central Administration Building, 508-799-8277. Thank you for your time and cooperation.

Sincerely,

Team MCAS Analysis

KEY: Reasons for Leaving a Worcester School :

1. Housing: Child moves within Worcester to a different housing location
2. Move out of Worcester entirely
3. Move out of state
4. Move out of country
5. Family break-up
6. Transfer to a magnet school in Worcester
7. Transfer to other, non-magnet school
8. Transfer to other school in Worcester in order to keep siblings together
9. Transfer to parochial school
10. Transfer to charter school
11. Other: Please clarify on reverse
12. Unknown reason

School Name: ____

Withdrawal Date	Last Name	First Name	Middle	1	2	3	4	5	6	7	8	9	10	11	12
8/25/98	DOE	JOHN													

(ACTUAL NAMES OMITTED FOR CONFIDENTIALITY)