April 2003

Impacts of Tougher Graduation Requirements on Course Selection and Learning in High School and Post High School Experiences of Vocational Students

John H. Bishop
Cornell University, jhb5@cornell.edu

Ferran Mane
Universitat Rovira i Virgili, fmv@fcee.urv.es

Impacts of Tougher Graduation Requirements on Course Selection and Learning in High School and Post High School Experiences of Vocational Students

Abstract

[Excerpt] The paper began with an examination of the effects of tougher graduation requirements on course taking patterns in high school. High school graduation tests reduced the number of occupational vocational courses taken by students and lowered their likelihood of becoming vocational concentrators. While this finding confirms the hypothesis we specified at the start, the rest of our findings contradict conventional wisdom and our initial hypotheses. Increased course graduation requirements did not decrease vocational course taking. Indeed, students in states with above average Carnegie unit graduation minimums took significantly more vocational education courses than students in states with low minimums. An even more surprising finding was the absence of significant increases in academic course taking in states and school districts with tougher graduation requirements. Instead tougher graduation requirements seem to have increased the number of art, music, health and other personal interest courses taken. We doubt this is what policy makers had in mind when they established these policies. Why do minimum competency exams appear to increase personal interest course taking and not academic course taking? What is it about higher course graduation requirements that results in students taking more personal interest courses and not taking more academic courses? Possibly, what is distinctive about states with high Carnegie unit graduation minimums is that they require extra personal interest courses or extra elective courses not extra academic courses. More research is needed on the impacts of individual components of state course graduation requirements on course taking, test score gains and other outcomes.

The paper then examined the determinants of test score gains between 8th and 12th grade in core academic subjects. Not surprisingly, gains were larger for students who took many academic courses and smaller for those who took introductory vocational courses. Occupational courses and personal interest courses had no effect on test score gains. Course graduation requirements and local option minimum competency exams had no effect (either direct or indirect) on learning during high school. State minimum competency examinations modestly increased learning by non-vocational students but not by vocational concentrators.

Keywords

impact, graduation, requirements, school, vocational, student, learn, course, college

Comments

Suggested Citation

Bishop, J. H. & Mane, F. (2003). *Impacts of tougher graduation requirements on course selection and learning in high school and post high school experiences of vocational students* (CAHRS Working Paper #03-09). Ithaca, NY: Cornell University, School of Industrial and Labor Relations, Center for Advanced Human Resource Studies. http://digitalcommons.ilr.cornell.edu/cahrswp/32

CAHRS
Center for Advanced Human Resource Studies

CAHRS / Cornell University
187 Ives Hall
Ithaca, NY 14853-3901 USA
Tel. 607 255-9358
www.ilr.cornell.edu/CAHRS/

Working Paper Series

Impacts of Tougher Graduation Requirements on Course Selection and Learning in High School and Post High School Experiences of Vocational Students

John Bishop
Ferran Mane

Working Paper 03 – 09

CORNELL ilr School of Industrial and Labor Relations

Impacts of Tougher Graduation Requirements on Course Selection and Learning in High School and Post High School Experiences of Vocational Students

John H. Bishop
Ferran Mane
Bishop Associates
327 The Parkway
Ithaca, NY 14850
jhb5@cornell.edu
fmv@fcee.urv.es

February 2001
[Revised April 2003]

Abstract

This report was prepared for the National Assessment of Vocational Education, pursuant to Task Order -- Impacts of MCE's and Higher Graduation Requirements on Vocational Participation and Outcomes**.** The Project Officer was Marsha Silverberg. The findings and opinions expressed in this report do not necessarily reflect the position or policies of the U.S. Department of Education.

Executive Summary

Of Impacts of Tougher Graduation Requirements on Course Selection and Learning in High School And Post High School Experiences of Vocational Students

The paper began with an examination of the effects of tougher graduation requirements on course taking patterns in high school. High school graduation tests reduced the number of occupational vocational courses taken by students and lowered their likelihood of becoming vocational concentrators. While this finding confirms the hypothesis we specified at the start, the rest of our findings contradict conventional wisdom and our initial hypotheses. Increased course graduation requirements did not decrease vocational course taking. Indeed, students in states with above average Carnegie unit graduation minimums took significantly more vocational education courses than students in states with low minimums. An even more surprising finding was the absence of significant increases in academic course taking in states and school districts with tougher graduation requirements. Instead tougher graduation requirements seem to have increased the number of art, music, health and other personal interest courses taken. We doubt this is what policy makers had in mind when they established these policies. Why do minimum competency exams appear to increase personal interest course taking and not academic course taking? What is it about higher course graduation requirements that results in students taking more personal interest courses and not taking more academic courses? Possibly, what is distinctive about states with high Carnegie unit graduation minimums is that they require extra personal interest courses or extra elective courses not extra academic courses. More research is needed on the impacts of individual components of state course graduation requirements on course taking, test score gains and other outcomes.

The paper then examined the determinants of test score gains between 8th and 12th grade in core academic subjects. Not surprisingly, gains were larger for students who took many academic courses and smaller for those who took introductory vocational courses. Occupational courses and personal interest courses had no effect on test score gains. Course graduation requirements and local option minimum competency exams had no effect (either direct or indirect) on learning during high school. State minimum competency examinations modestly increased learning by non-vocational students but not by vocational concentrators.

The next outcome examined was college attendance. Not surprisingly, the number academic courses completed had a strong relationship with college attendance. Occupational vocational courses and personal interest courses also had significant positive relationships with college attendance but the magnitude of these effects was much smaller than for academic courses. State and local minimum competency examinations had large significant positive effects on the college attendance rates of vocational concentrators but no effects on other students. State and local course graduation requirements, by contrast, had large negative effects on college attendance. This implies that even though graduates who take extra courses in high school are much more likely to go to college, requiring students to take more courses by raising course graduation requirements tends to lower college attendance rates not raise them as intended.

Finally we examined the effect of course taking patterns and graduation requirements on labor market outcomes immediately after high school graduation. Holding college attendance constant, high school graduates who pursued a vocational concentration got higher wage jobs, were less likely to be unemployed and earned significantly more per month and per year than students who took no occupational vocational courses. Graduates who took above average numbers of academic courses were paid significantly less per hour, worked fewer months and earned less per month. While wage rates were influenced by course taking patterns, the likelihood of receiving employer provided training was not.

Of the four graduation requirements evaluated, only one had positive effects on labor market outcomes immediately after high school. Increased state and local course graduation requirements and local minimum competency examinations were not associated with better labor market outcomes. State minimum competency examinations, by contrast, were associated with dramatically improved labor market outcomes. Graduates from MCE states who did not do a vocational concentration, earned 6 to 7 percent more per month and 9 percent more per annum than similar graduates in non-MCE states. Vocational concentrators benefited even more from growing up in a MCE state. In the 21 months after graduating they were one-third less likely to be unemployed, 8 percent more likely to be employed, paid 8 percent more per hour and earned 15 percent more per month. Employed graduates with vocational concentrations were also significantly more likely to get formal training when they lived in states with MCEs.

Policy Implications

Clearly the policy with the least to recommend it is increases in the total number of Carnegie units required to graduate from high school. Graduates educated in states with high course graduation requirements do not take and pass more academic courses, do not learn more during high school and do not earn more after high school. They are significantly less likely to go to college and are paid slightly less per hour when they work. In addition, Dean Lillard and Phillip DeCicca (2001) have found that dropout rates rise when states increase the number of courses students must take to graduate from high school.

Variations in the number of elective and personal interest courses required account for most of the variance in the state set minimums for total numbers of courses required to graduate. In many cases, high course graduation requirements are the result of mandated electives and mandated art, music and health requirements. States should scale these non-academic requirements back. No state currently requires students to take more than 14 courses in the four core academic fields. Consequently the total number of courses required to graduate can be lowered without reducing the number of courses required in English, mathematics, science and social studies.

The policy with the most to recommend it is state minimum competency examinations. Test score gains by non-vocational students are somewhat higher in MCE states and vocational concentrators are more likely to go to college. Labor market outcomes are substantially better for both types of students in MCE states. On the other hand, state MCEs delay or prevent some students from graduating (Bishop et al 2001) and reduce the share of graduates who do a vocational concentration. The vocational concentrators who meet the higher academic standards, however, benefit greatly from the signal that MCEs sends to employers. Employers are in effect being told: “Vocational concentrators have both the occupational skills you seek and the academic skills you seek.” The enhanced reputation of vocational concentrators makes them much more marketable. In our view, these findings tend to support the emphasis heavy emphasis on combining rigorous academic coursework with specialization built around an occupational theme that characterizes the two best know whole-high-school reform models—High Schools that Work and Talent Development High Schools.

Impacts of Tougher Graduation Requirements on Course Selection and Learning in High School And Post High School Experiences of Vocational Students

Graduation requirements are getting tougher. Many states have increased the number of course credits students must amass to graduate from high school. In 1996, seventeen states and a number of urban districts were awarding high school diplomas only to students who had passed a minimum competency exam. Table 1 presents 1980-82 and 1992 data from a survey of principals on the proportion of high school students who faced such a requirement. Minimum competency examination (MCE) graduation requirements were often established in response to a popular perception that the state or district's K-12 education system had failed. Generally speaking it has been southern states and states and districts with large urban populations that have established MCEs. As a result, students from low socio-economic backgrounds and students with low test scores are more likely to attend schools with MCEs.

Many vocational educators have been concerned about how their students are being affected by minimum competency test graduation requirements and by increases in the number of academic courses required for graduation. Advocates for at-risk youngsters many of whom find their way into vocational education are also concerned. Despite these widespread concerns, there has been no research on the impacts of these two policies on students pursuing applied technical studies in high school. This paper will attempt to remedy this gap in the literature. It is divided into two parts. Part one examines the impact of tougher graduation requirements on vocational course taking. We find that high school graduation tests have contributed to recent declines in vocational course taking and in the proportion of students becoming vocational concentrators. Increased course graduation requirements, by contrast, do not appear to have decreased vocational course taking. Indeed, students in states with above average Carnegie unit graduation minimums take more vocational education courses than students in states with low minimums.

Part two examines the impact of graduation requirements on learning, college attendance and post high school labor market outcomes. Part 3 summarizes findings and discusses policy implications.

I. Effects of Graduation Requirements on Participation in Vocational Education

What has been the effect of high school graduation tests and Carnegie unit graduation requirements on the number of vocational courses taken by high school students and the proportion of high school graduates who complete a vocational concentration? Does it matter whether these requirements are imposed by state government or by local school districts? Our hypotheses about these matters are presented in Exhibit 1.

Exhibit 1--Hypotheses about Effects of Graduation Requirements on Choice of High School Courses (controlling GPA and test scores in 8th grade)

- MCEs reduce vocational coursework
  - > particularly for low GPA students
- MCEs increase academic coursework
  - > particularly for low GPA students
- Increasing the number of courses required to graduate will:
  - —increase academic course taking
  - —increase/reduce the number of other courses taken
  - —Increase/reduce the number of vocational concentrators and vocational courses taken

Our study of these issues makes use of micro data from the National Educational Longitudinal Study (NELS-88), a longitudinal data set that followed a nationally representative sample of 8th graders in 1988 through the year 1994. We studied the subset of NELS:88 high school graduates who were in public schools in 10th grade and earned between 15 and 32 Carnegie units during high school.

We used the restricted data set that identifies the state in which the student's high school was located. This allows us to merge information on state policies and characteristics into the data set: the minimum number of Carnegie units required to get a diploma set by state law and a dummy variable for state minimum competency exams. MCESTATE was equal to 1 for students in states with minimum competency exam as a graduation requirement in 1992 (Alabama, Florida, Georgia, Hawaii, Louisiana, Maryland, Mississippi, Nevada, New Mexico, New Jersey, New York, North Carolina, South Carolina, Tennessee, and Texas) and zero elsewhere.[1]

Most school districts establish higher graduation requirements than the minimums set by state law and a few have established their own graduation tests. Information on school district graduation requirements was obtained from questionnaires completed by the principal of the student's high school in 1990 and 1992. The Local MCE variable used in this paper is the average of the 1990 and 1992 responses to the question. Thirty-six percent of our sample lived in states that mandate the MCE and set the graduation standard on the exam. Another twenty percent live in school districts that set their own cut scores on a state devised test or have established their own graduation exam.[2]

Since the outcomes studied are primarily determined by the student's background and environment, we control for as many characteristics of the community and the student as possible in order to increase efficiency and reduce omitted variable bias. Our estimations include controls for grade point average in 8th grade, an average of 8th grade test scores in English, mathematics, science and social studies and other characteristics of the student in 8th grade. These included whether the student took remedial courses in 8th grade or earlier, whether they taken advanced courses, TV and homework hours, reading for pleasure, an indicator for being handicapped, socio-economic status of the student's family, logarithm of the number of books in the home, parent involvement index, family size, marital and parental status in 8th grade, locus of control index, self esteem index and hours working for pay during 8th grade (and it's square), an index for smoking in 8th grade, dummies for race, ethnicity and religion and rural, suburban and urban residence and six variables describing the quality of the high school.

From the principal's questionnaire we took the following indicators of quality of the student's secondary school: dummy variables for Catholic school, for secular private schools and for schools formed by non Catholic religious organizations, average teacher salary, the pupil-teacher ratio, percent free lunch, percent students that were white and average enrollment per high school grade (and its square). Two other measures of the quality of the school attended in 10th grade—the average socio-economic status and 8th grade test scores of students at the school—were calculated by averaging student responses for each high school in the NELS:88 data base. We also included control variables measuring the following characteristics of the state: unemployment rate, mean weekly wage in retailing, ratio of the high school graduate earnings to the high school dropout earnings in 1989, ratio of college graduate earnings to high school graduate earnings in 1989, ratio of tuition at four year public colleges to the weekly earnings in retailing and dummies for 4 Census regions.

These controls for school characteristics and region may not be sufficient to avoid omitted variable bias. States and school districts with such exams may be different along unmeasured dimensions that have direct effects on graduation rates, college attendance and wage levels. A positive selection bias is unlikely, however, because most states appear to have adopted MCEs and higher course graduation requirements as a response to a perception that the state's schools were failing to teach basic skills. By 1992 MCEs had been adopted by every southern state except Arkansas and Oklahoma. With the exception of New Mexico, none of the Mountain, Plains or Midwestern states had established a MCE prior to 1992.[3] All our estimates report Huber-White robust standard errors that account for the clustering of students within schools and deals with the problem of the correlation of errors generated by the cluster-based sampling frame.

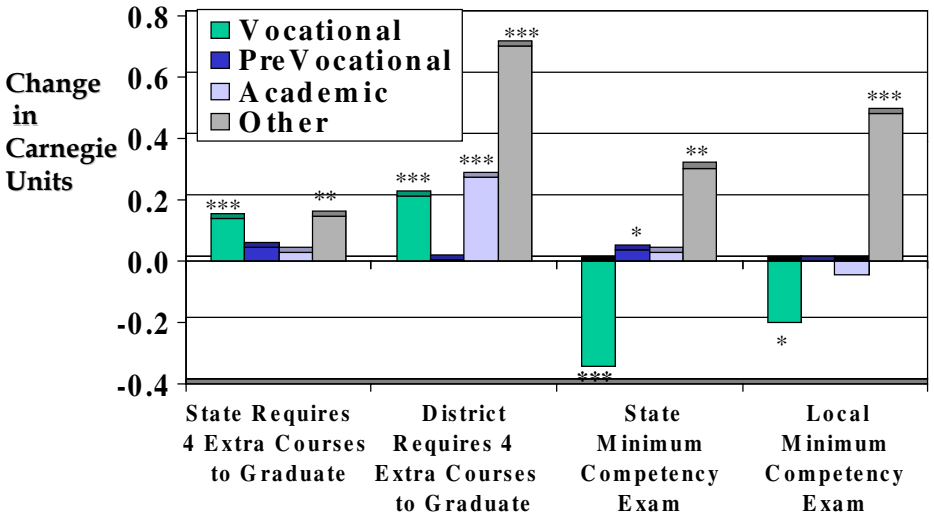
The results of regressing high school course taking patterns on indicators of student achievement in 8th grade, a host of student background factors and graduation requirements is given in Table 2. The first row of the table gives the means and standard deviations of the dependent variables. We aggregate the courses students take in high school into four subtotals.

The first category was introductory vocational courses (industrial arts, introduction to technology and home economics). Students completed an average of .53 Carnegie units of these courses during high school. This does not represent the totality of student exposure to these courses because in many states they are encountered in middle school and consequently would not show up in our data. The second subtotal, occupational vocational courses, included courses in computer skills, auto mechanics, construction, business, health occupations, etc. High school graduates accumulated an average of 2.35 Carnegie units of occupational vocational courses, about 10 percent of the total number of courses taken during high school. The standard deviation of this variable (2.03) was quite large relative to the mean indicating that some students took more than four courses while others took none. The third subtotal, academic courses, includes English, foreign languages, mathematics, science and social studies. Graduates completed an average of 15.36 full-year equivalent academic courses. This is 68 percent of the high school total. The final subtotal, Personal Interest Courses, includes art, music, health, driver education, photography, etc. The mean number of personal interest courses was 4.35 or roughly 20 percent of the total number of courses taken during high school.

The most important determinant of course taking patterns was academic achievement during 8th grade. If GPA is one point higher and 8th grade test scores are one SD higher, our regression predicts the graduate will complete two additional academic courses, .09 additional personal interest courses, .18 fewer introductory vocational courses and .50 fewer occupational vocational courses. The second most important determinant of course taking patterns was the socio-economic status (SES) of one's parents. High SES students took fewer vocational courses, more academic courses and more personal interest courses.

The impacts of state and local graduation requirements on course taking patterns are given in rows 2 through 5 of Table 2 and in Figure 1.

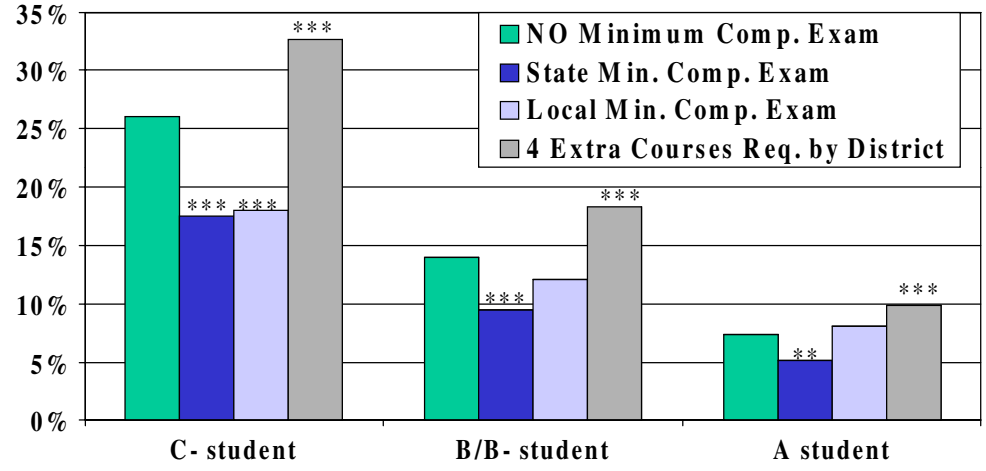
Figure 1--Effects of Graduation Requirements on Courses Taken in Public High Schools



Source: NELS:88 students who earn 15+ Carnegie units--controls for attitudes, socio-economic status, GPA & test scores in 8th grade, state & high school characteristics.

Minimum competency exams significantly reduced the number of occupational vocational courses taken by graduates and the probability of becoming a vocational concentrator. The impact of MCEs on vocational course taking was larger for C students than for A students (see Figure 2).

Figure 2-- Incidence of Vocational Concentrators by 8th grade GPA & Minimum Competency Exams



Source: Analysis of NELS:88 data on public school students with 15F Carnegie Units--controls for attitudes, socio-economic status, GPA & test scores in 8th grade, state & high school characteristics.

While these results were anticipated, most of the other findings were a surprise. We had expected state and local MCE graduation requirements to increase academic course taking. They did have an effect on C students but no effect on B students or A students. Instead the primary response to MCEs were big increases in the number of personal interest courses (mainly art, music and health) taken.

We had also expected students in states with high course graduation requirements to take more academic courses and fewer vocational courses. That was not the case. Instead the students in these states took significantly more art, music and health courses and also significantly more vocational courses but no additional academic courses. Local course graduation requirements also had large effects on the number of art, music and health courses taken and much smaller positive effects on the number of core academic courses and vocational courses taken.

How might these puzzling findings be explained? One possibility is the low correlation between the number of academic course (math, science, social studies, English and foreign languages) required and the total number of courses required to graduate. They correlate only .22. Thus some of the states with high academic course requirements may not have above average total course graduation requirements. Another problem may be the 7 states that do not set state minimum course graduation requirements. In the model presented in table 2, states without a statewide minimum were assigned a value of 13—the lowest minimum Carnegie unit requirement for the states with a requirement.

To fix these problems we re-estimated our models including a zero-one variable for states without course graduation requirements and a measure of the academic course graduation requirements. Data is available on the academic course graduation requirements set by states but not the academic requirements of individual high schools. Consequently, we dropped the local total course graduation requirement variable from the model and focused solely on the effects of state course graduation requirements--both total and academic. The results are reported in Table 3.

As expected, academic course requirements had large and significant effects on the number of academic courses taken. Each one-unit increase in academic course requirements was associated with a .15 increase in the number of academic courses taken. Total course graduation requirements had no effect on academic course taking but did have significant positive effects on the number of vocational courses and the number of personal interest courses. Surprisingly, however, students in states with high academic course graduation requirements were more likely to become vocational concentrators and took significantly more occupational-vocational courses and personal interest courses. A one unit increase in academic course requirements was associated with a .176 increase in credits earned in these two non-academic areas.

II. Effects of Graduation Requirements on Learning, College Attendance and Labor Market Outcomes

MCE's are generally expected to have larger impacts on high school students who are at highest risk of failing them. Since students with low GPAs in 8th grade take more vocational courses in high school and are more likely to become vocational concentrators, many researchers have hypothesized that vocational concentrators will be more affected by minimum competency exams than other high school students. Our hypotheses about the expected effects of graduation requirements on vocational concentrators are presented in Exhibit 2.

Exhibit 2--Hypotheses about the Effects of Minimum Competency Exams on:

	VocCon	Other
Test Score Gains in high school	+ +	+
College Entry Fall following graduation	+ +	+
College Attendance one year later	+ +	+
Employment (controlling college attendance)	+ +	+
Unemployment (controlling college attendance)	**neg**	**neg**
Earnings (controlling college attendance)	+ +	+
Wage rate (controlling college attendance)	+ +	+
Employer Training (for those with a job)	+ +	+

To test these hypotheses we included two interaction variables in our models. The "*StateMCE X Vocational Concentrator"* variable is a 1 for vocational concentrators who live in MCE states and a zero otherwise. The "*LocalMCE X Vocational Concentrator"* variable is a 1 for vocational concentrators attending school in districts that have a local option MCE and zero otherwise. We are also interested in the effects of the course graduation requirements set by state governments.

These effects are captured by three variables: the minimum number of academic credits required to graduate, the minimum number of credits of any kind required to graduate and a zero-one dummy variable for states that did not specify course graduation requirements.

Results of the analysis predicting effort levels and test score gains during high school for our sample of high school graduates are presented in Table 4. Our analyses of college attendance rates and the receipt of employer sponsored training are presented in Table 5. Analyses of labor market outcomes after high school graduation are presented in Table 6. All of the tables have the same format so the sentences that follow describe the format of all three tables. The coefficients on the State MCE dummy variable [column 3] and Local MCE variable [column 6] are estimates of the impact of state and local MCEs on the 86 percent of high school graduates who did not do a vocational concentration. Coefficients testing the hypothesis that the impact of MCEs are different for vocational concentrator are reported in columns 4 and 7. Estimates of the impact of state MCEs on vocational concentrators are given in columns 5 and the impacts of local MCEs are given in column 8. The numbers in brackets underneath these two coefficients are the p values for a hypothesis test that the MCE's effects on vocational concentrators are significantly different from zero. Estimates of the impact of state mandated total Carnegie unit minimum graduation requirements are presented in column 9. The impacts of state set academic course graduation requirements are given in column 10. The number in brackets in the second row underneath this coefficient is the p values for a hypothesis test that academic course requirements have effects that are significantly different from zero. An estimate of the impact of establishing strong networks with local employers is given in Column 11.

Our hypotheses regarding the impacts of course taking patterns on learning and post high school outcomes are presented in Exhibit 3.

Exhibit 3--Hypotheses about Effects of Coursework on Learning, College Attendance & Labor Market Outcomes

- **Academic courses have larger positive effects on gains on academic tests and on college attendance than other courses?**
- **Vocational Courses have [small positive/no/negative] relationships with test score gains and college attendance?**
- **Other Courses have a [small positive/no/negative] relationships with gains on academic tests and a modest positive effect on college entry.**
- **Vocational Courses increase employment, earnings, wage rates and job quality and reduce unemployment after graduation.**
- **Academic courses have negative relationships with labor market outcomes after graduation.**
- **Other courses have no relationship with labor market outcomes.**

Tests of these hypotheses are reported in the right hand side of Tables 3, 4 and 5. The effects of vocational course taking are captured by two variables: a dummy variable for being a vocational concentrator (column 12) and the number of occupation-oriented vocational courses taken (column 13). The effects of introductory vocational courses such as home economics, introduction to technology and industrial arts are given in column 16. The effects of academic courses—math, language arts, science, social studies and foreign languages-- are reported in column 14. The effects of all other high school courses—fine arts, music, theatre, photography, drivers education, etc.—are reported in column 15 of the tables. Adjusted R square of the model and the number of observations available for the analysis are reported in the last column of the table.

2.1 Determinants of Study Effort and Test Score Gains

Models were estimated predicting gains on a composite of test scores from 1988 to 1990, gains from 1990 to 1992 and gains during the full 4-year period from 1988 to 1992. We used the Thetas produced by the IRT model because they have the normal distribution called for by the statistical program we are using. Separate models were also estimated for gains from 1988 to 1992 for English, mathematics, science and social studies. In order to prevent the measurement error in the test scores from biasing the results, the lagged value of the test whose gain score was being predicted did not appear on the right hand side of the regression.[4] When the gains on individual tests were being predicted, however, the student's scores on the other three 8th grade tests were included as control variables. The student's GPA in 8th grade was also one of the control variables in all models.

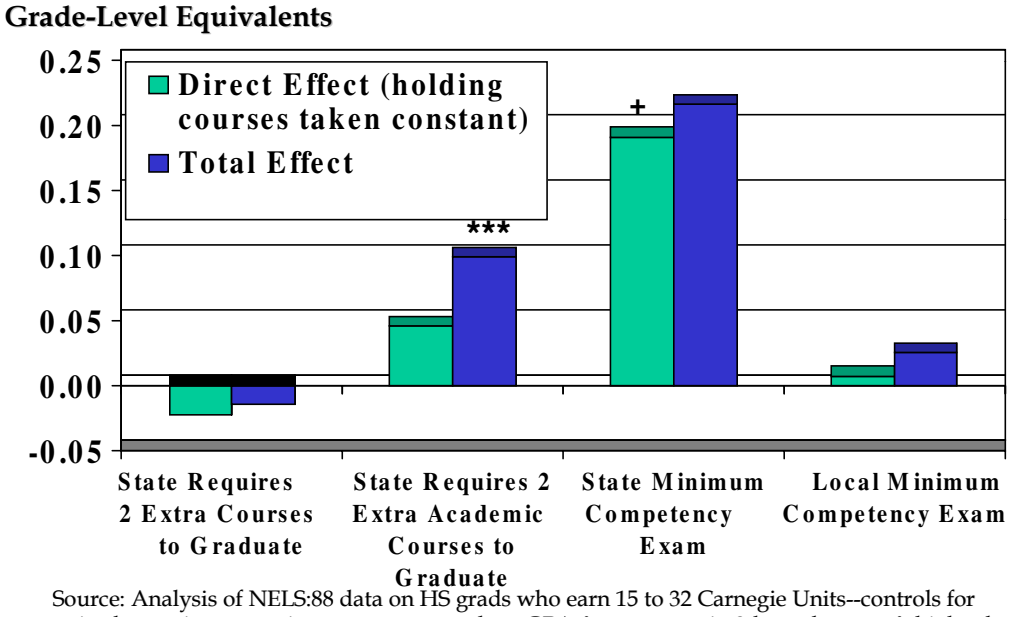
Course taking patterns are clearly very important predictors of learning during high school. Holding 8th grade GPA, 8th grade test scores and other high school courses constant, academic courses were associated with substantial gains in math, science, social studies and English. Each extra academic course was associated with a .207 GLE gain in science, a .223 GLE gain in Mathematics, .12 GLE in social studies and a .268 GLE gain in English.[5] Other types of courses, by contrast, tended to have either negative effects or no effect on learning gains in the four core subjects. Introductory vocational courses taken during high school were associated with significantly reduced learning in math and English. One extra occupational vocational course was associated with reading gains that were 8 percent of a GLE higher but learning gains in other subjects were unaffected. The residual category of courses--fine arts, driver education, etc—had no effect on learning in the four core subjects.

What were the other statistically significant determinants of 8th to 12th grade learning as measured by the four-subject composite? During the 4-year interval, males learned .46 of a grade level equivalent more than females, African-Americans learned .47 GLEs less than whites and students living in the West learned .50 GLEs more than students in the Northeast. Learning gains were also greater for students from high SES families, for students high on the read for fun index

and high on the internal locus of control index and for students who watched a great deal of TV in 8th grade. Learning gains were greater when pupil teacher ratios were low, at schools serving high SES students and at schools where entering students had low 8th grade test scores.

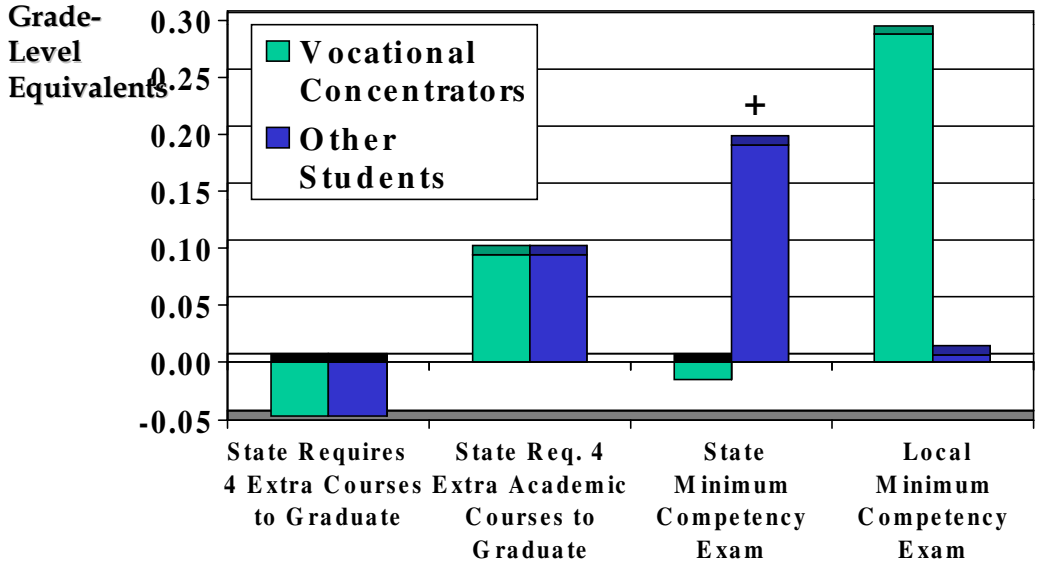
Effects of Graduation Requirements**:** Our estimates of the effects of graduation requirements on test score gains are presented in Figure 3, Figure 4, and in Table 3.

Figure 3--Effects of Graduation Requirements on Achievement Gains of Academic and General Track Students



Source: Analysis of NELS:88 data on HS grads who earn 15 to 32 Carnegie Units--controls for attitudes, socio-economic status, courses taken, GPA & test scores in 8th grade, state & high school characteristics.

Figure 4—Direct Effects of Graduation Requirements on Achievement Gains by Vocational Status



Source: Analysis of NELS:88 data on HS grads who earn 15 to 32 Carnegie Units--controls for attitudes, socio-economic status, courses taken, GPA & test scores in 8th grade, state & high school characteristics. Effects through course taking not included in estimate.

Our first finding is that neither the total number of courses or the number of academic courses required for graduation had significant positive direct effects on gains on the test score composite (see column 9 and 10). Since total course graduation requirements also failed to increase the number of academic courses taken (the only category of courses that had significant positive effects on test score gains), total course graduation requirements also had no indirect effects on learning core academic subjects either. This finding has been replicated in an expanded data set that includes all 8th graders not just the students who graduated from high school.[6] While increasing the number of academic courses required to graduate does not increase learning directly, it does increase academic course taking and that increases learning. To see how big these effects are we calculated the total effect of academic course graduation requirements by summing direct and indirect effects.[7] For the test score composite the total effect of a one-unit

increase in academic course graduation requirements was .049 GLEs. These results suggest that academic course graduation requirements increase learning during high school but that the effects are rather modest.

Our second finding is that local MCEs also failed to have positive effects on test score gains during high school by the 86 percent of students who do not concentrate in an occupational field (see Figure 4). Positive effects were found on science learning, but these were counter balanced by negative estimated effects of local MCEs on English and social studies learning. Point estimates of the effects of local MCEs on learning were generally positive for vocational concentrators but none were statistically significant.

State MCEs, by contrast, appear to have had small positive effects on students who do not take a vocational concentration. Non-vocational students who lived in MCE states had significantly (at the 5 percent level on a one tail test) larger gains in math and science. For the test score composite the estimated direct effect (significant at the 10 percent level on a one tail test) of living in a MCE state was .19 of a grade level equivalent. When indirect effects are added in the total effect was .217 GLE for non-vocational students. Additionally students in MCE states report working harder in their academic courses.

Contrary to our hypothesis of positive interactions between MCEs and vocational concentrators, the impact of state MCEs on test score gains of vocational concentrators was smaller than for non-vocational students. Indeed, for vocational concentrators, state MCEs did not have significant positive effects on the hard work index or any of the seven test score gain indicators analyzed and most of the point estimates were close to zero.

2.2 Determinants of College Enrollment Rates

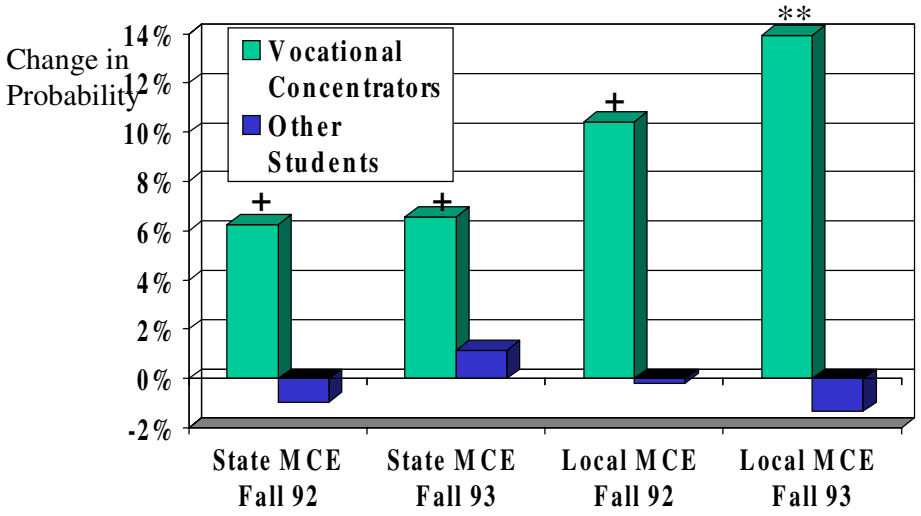
Logistic regressions were estimated predicting college enrollment in the fall of 1992, spring of 1993, fall of 1993 and the spring of 1994 of high school graduates who earned 15 to 32 course credits in high school. In almost all respects the model specifications were the same as those used in the test score gain models.[8] We also estimated models for high school graduates who were employed in 1993 or 1994 predicting whether they received on-the-job

training or participated in a formal training course. The results are presented in Table 5. The approximate effect of X_i (at the mean of the dependent variable) on the probability of attending college can be obtained by multiplying β_i times P(1-P). Since the mean probability of attending college is about .5 in our data, this multiplier is .25 for college attendance. The multiplier is .12 for Employer OJT and .184 for Formal Training.

If tougher high school graduation requirements induce students to study harder and take additional academic courses, one would expect them to increase the proportion of high school graduates who attend and complete college. Analyzing HSB data, Bishop and Mane (1999) found that high school graduates coming from high schools with an MCE graduation requirement [as reported by the principal] were significantly more likely to be in college during the four-year period immediately following high school graduation. Effects were largest for students in the middle and bottom of the test score distribution and tended to be larger in the 2nd and 3rd years out than in the 1st, 4th and subsequent years out.

Effects of Minimum Competency Exams: The analysis presented here is for 1992 high school graduates rather then 1980 graduates and controls are included for course taking patterns. We found that state MCEs and local MCEs had no significant effects on college attendance rates of students who did not do a vocational concentration (see Figure 5).[9]

Fig. 5--Effects of Minimum Competency Exams on the Probability of Attending College



Source: Analysis of NELS:88 data on HS grads who earn 15 to 32 Carnegie Units--controls for attitudes, socio-economic status, courses taken, GPA & test scores in 8th grade, state & high school characteristics.

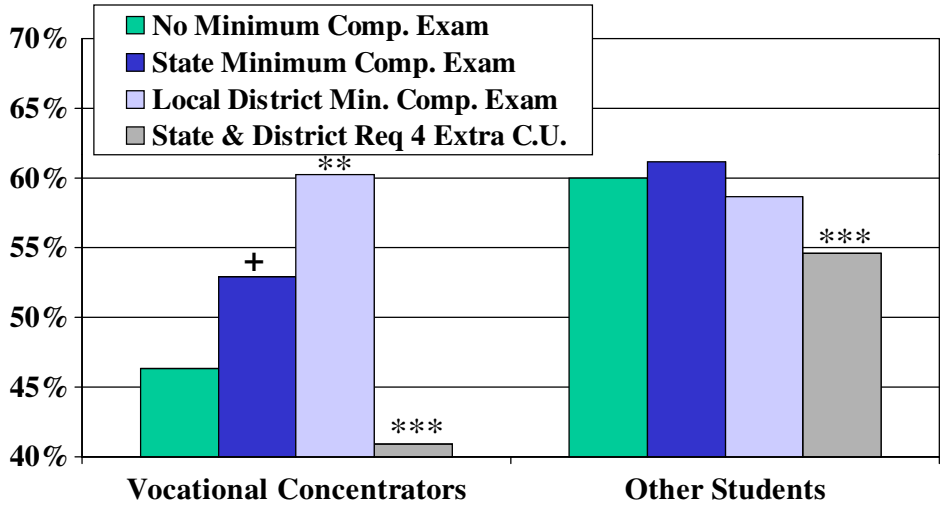
They did, however, have strong positive effects on college attendance rates of vocational concentrators. Holding course-taking patterns constant, attending a high school with MCE graduation requirements raised college attendance rates of vocational concentrators by about 6 percentage points. Since MCE's induce students to take more academic courses, the indirect effects of MCEs on college attendance reinforce the direct effects.

Effects of Course Graduation Requirements: The number of academic course credits earned in high school was a very strong predictor of college attendance (see Table 5). One additional academic course was associated with college attendance rates that were 6 to 7 percentage points higher. Occupational vocational courses and art and music courses had much smaller positive effects on college attendance rates. One additional course of this type was associated with college attendance rates that were 1 to 2 percentage points higher. Thus substituting an occupational vocational course for personal interest courses has no effect on college attendance rates. Substituting a vocational course for an academic course, however,

lowers college attendance rates by about 5 percentage points per course. Taking a heavy schedule of vocational courses and becoming a vocational concentrator is also associated with a 3 to 6 percentage point reduction in college attendance rates.

Our estimates of the **direct** effects of graduation requirements on college attendance are displayed in both Figure 6 and Table 5.

Figure 6-- Probability of Attending College in Fall 1993 by Graduation Requirements & Vocational Status



Source: Analysis of NELS:88 data on HS grads who earn 15 to 32 Carnegie Units--controls for attitudes, socio-economic status, courses taken, GPA & test scores in 8th grade, state & high school characteristics. **'s and +'s indicate whether the contrast with the bar for No MCE is statistically

Since the policies being studied were intended to change course taking patterns and controls are included in the model for these course taking patterns, the estimates of **direct** effects we present represent only one of the two ways in which graduation requirements might change college attendance rates. We have also calculated the size of the indirect effects operating through course taking patterns. When indirect effects are important, they are discussed in the text. When indirect effects are small, our discussion of them is in an endnote.

Our first finding is that the direct effects of higher state minimum course graduation requirements on college attendance are significantly negative and substantively important. We begin by looking at the effect of an increase in the total number of courses required while academic course requirements are held fixed. A two Carnegie unit increase in the total number of

courses required to graduate reduced predicted college enrollment rates by 2 percentage points in the fall 1992 and Spring 1994 and by 1.2 to 1.6 percentage points in spring 1993 to fall 1993. Since increases in the total number of credits do not increase academic course taking, our regressions imply that increased total course graduation requirements reduce college attendance rates of high school graduates.

Now let us examine the effect of increases in academic course requirements while holding total course requirements fixed. The direct effects are again significantly negative. Each one-unit increase in academic requirements lowers college attendance rates by more than one percentage point. However, the increase in the number of academic courses brought about by the graduation requirement has the opposite effect, so we must sum direct and indirect effects to assess total effects of the policy. Our regressions imply that the indirect effects of increases in state academic course requirements just about completely offset the negative direct effects of the policy, so the total effects of the policy on college attendance rates are essentially zero.

These findings are remarkably robust. We estimated models predicting college attendance in a data set that included all 8th graders (not just high school graduates who earn at least 15 Carnegie units as in this paper). We found that increases in total course graduation requirements (holding academic course requirements constant) significantly lowered college attendance rates. Increases in academic course requirements holding total course requirements constant had no effects on college attendance rates.[10] This is a very important finding. It implies that even though graduates who take extra courses in high school are much more likely to go to college, requiring students to take more courses by raising academic course graduation requirements does not raise college attendance rates as intended.

Other determinants of college attendance: Students with the highest college enrollment rates attended schools serving high SES communities, schools that paid their teachers more than average, small high schools and Catholic high schools and lived in communities with high unemployment rates. The school and state characteristics that did not have significant effects on enrollment rates were pupil/teacher ratio, the college-high school wage ratio, weekly earnings in

retailing and the cost of tuition at public four-year colleges. Cooperative arrangements with local businesses also had no effect on college attendance rates.

With respect to the individual control variables, few of the findings are surprising. Holding other characteristics constant, those who attended college tended to come from small, intact, high SES families, tended to be Asians or African-American rather than white, to have a Catholic or Jewish religion rather than Protestant, no religion or no response to the religion question, high on the internal locus of control index, non-smokers who did not read for fun much but spent many hours doing homework in 8th grade.

2.3 Determinants of Post High School Labor Market Outcomes

MCEs are hypothesized to improve job opportunities in two ways. First, by improving student achievement they raise worker productivity.[11] Even when this does not immediately raise workers' earnings, the effect of academic achievement on wages grows with time and eventually becomes very large[12].

The second way MCEs are hypothesized to improve job opportunities is by sending a signal to employers that "ALL the graduates of this high school meet or exceed your hiring standards." The fact that they have passed the MCE is the proof. In most communities, competencies developed in the local high school are poorly signaled to employers. The lack of signals of achievement in high school tends to make employers with the best jobs reluctant to risk hiring recent high school graduates. Indeed they often carry in their head very negative stereotypes regarding recent high school graduates. A black personnel director interviewed for a CBS special on educational reform proudly stated, "We don't hire high school graduates any more, we need skilled workers."[13] They prefer, instead, to hire workers with many years of work experience because the applicant's work record serves as a signal of competence and reliability that helps them identify the most qualified.

Establishing a minimum competency exam, therefore, is one way a school district or state education system can try to overcome this signaling problem and help it's graduates get good jobs.

The existence of the minimum competency exam graduation requirement should be well known to local employers. With the MCE requirement, the school's diploma now signals more than just seat time; it signals meeting or exceeding certain minimum standards in reading, writing, mathematics, science and social studies as well. Efforts to convince employers that students now graduating from high school have the academic skills they want appear to be succeeding. Public Agenda's 2001 survey of a representative sample of employers who make hiring decisions for jobs often filled by recent high school graduates found that "Employers still voice considerable doubts about student's basic skills, but almost two-thirds (64 percent) acknowledge that students don't graduate from local schools unless they have learned what was expected of them, up from 51 percent in 1999 (p. S3)."[14]

Because of pooling, all high school graduates should benefit from a MCE regime. The positive effects of MCEs on the reputation of a recent graduate may be particularly large for vocational concentrators. When there is no MCE graduation requirement, local employers may suspect that vocational concentrators have poor basic skills. The MCE requirement takes that stigma away and allows employers to focus instead on the occupation specific skills they can anticipate getting when they hire a recent graduate of a high school vocational program.

The foregoing logic generates a number of testable predictions regarding the graduates of high schools with a MCE graduation requirement. Holding constant socio-economic status (SES), 8th grade test scores, 8th grade GPA, working during 8th grade, attitudes in 8th grade, whether the individual gets a diploma or a GED, current and past college attendance and a complete set of other individual and school characteristics:

Hypothesis A---Students in MCE states will obtain higher wage rates and higher earnings than students at states without MCE graduation requirements.

Hypothesis B---MCEs will have larger positive effects on the labor market outcomes of vocational concentrators that on academic or general track students.

Previous research: Analyzing High School and Beyond data and controlling for college attendance and a host of other variables, Bishop, Moriarty and Mane (1998) found that females

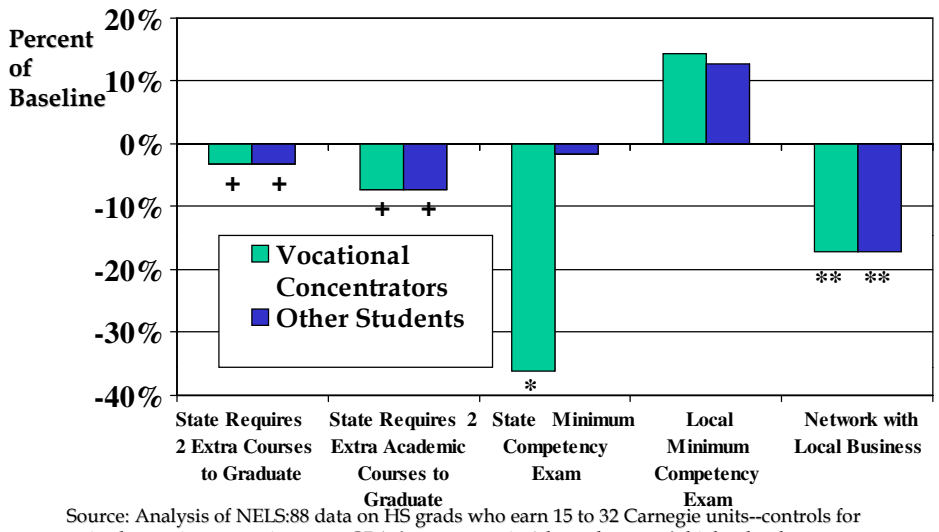
graduating from high schools with a minimum competency exam graduation requirement [student report] earned more than women graduating from schools without an MCE. Concern about the accuracy of student reports of the existence of a MCE at their high school led Bishop and Mane (1999) to reanalyze HSB data using principal reports of the existence of a MCE graduation requirement. They found even larger effects. Principal reports of a MCE graduation requirement had positive effects (significant in some but not all years) on wage rates of male and female graduates and on the earnings of graduates four and five years after graduation. The wage rate effects of MCE's appeared to be larger for students in the bottom three quarters of the test score distribution.

Here we analyze NELS-88 data on high school graduates and allow state mandated MCEs to have different effects from MCEs established by local districts. We also control for high school course taking patterns and test whether MCEs have different effects on vocational concentrators. Models were estimated predicting six indicators of early labor market outcomes: earnings in calendar 1993, average monthly earnings, monthly earnings in January/February 1994, the hourly wage rate, the total number of months worked and the total number of months unemployed during the 21 month period following high school graduation.[15] The estimations are a decided improvement over the analyses previously conducted in High School and Beyond data because the use of restricted data allows us to include controls for the unemployment rate in the state and the average earnings in manufacturing and retailing for the state.

With two exceptions the models predicting these labor market outcomes were the same as those used to predict college attendance. The first exception to that generalization was the inclusion of controls for current and past college attendance: a dummy variable for full-time college attendance during the period for which earnings is measured, a dummy for part time attendance during that period and the number of semesters of college attendance prior to the earnings measurement period. The second exception was the inclusion of controls for "Ever dropped out," "Obtained a GED," "graduated early" and, for late graduates, "the length of the delay in graduation."

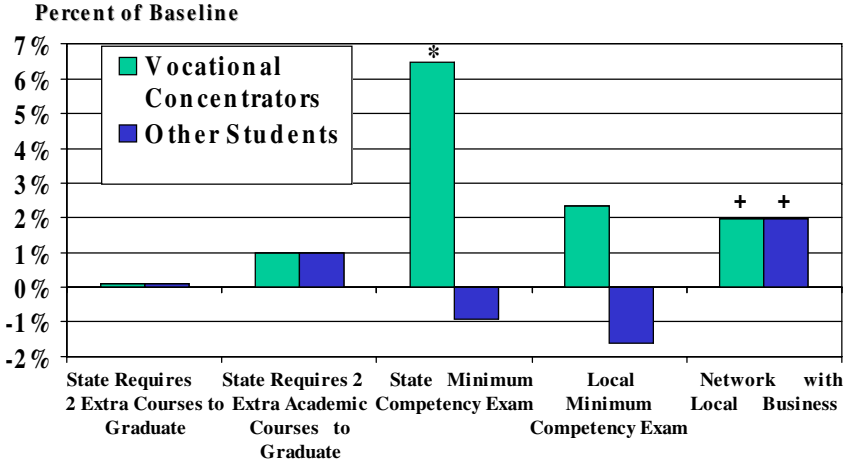
Table 5 presents our analysis of the determinants of the earnings and employment of recent high school graduates. Our estimates of the effects of graduation requirements are also depicted in Figures 7, 8, 9 and 10.

Figure 7–Total Effects of Graduation Requirements on Unemployment of Vocational Concentrators



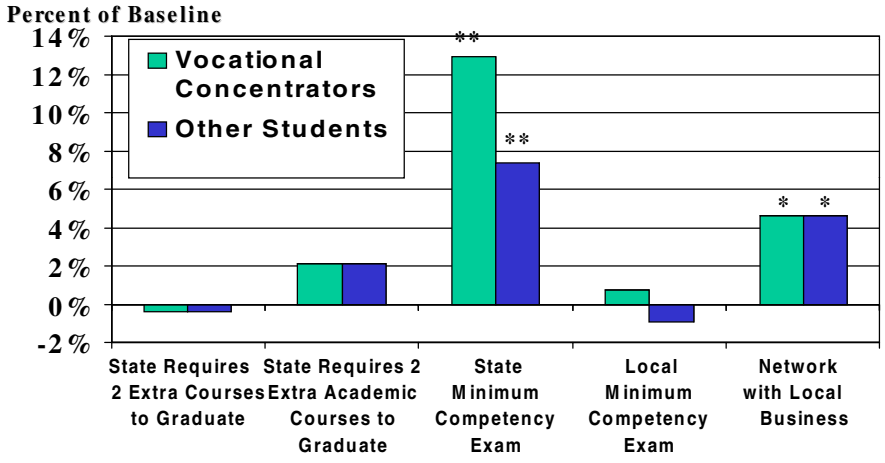
Source: Analysis of NELS:88 data on HS grads who earn 15 to 32 Carnegie units--controls for attitudes, socio-economic status, GPA & test scores in 8th grade, state & high school characteristics. Effects through courses taken are included.

Figure 8— Total Effects of Graduation Requirements on Employment of Vocational Concentrators



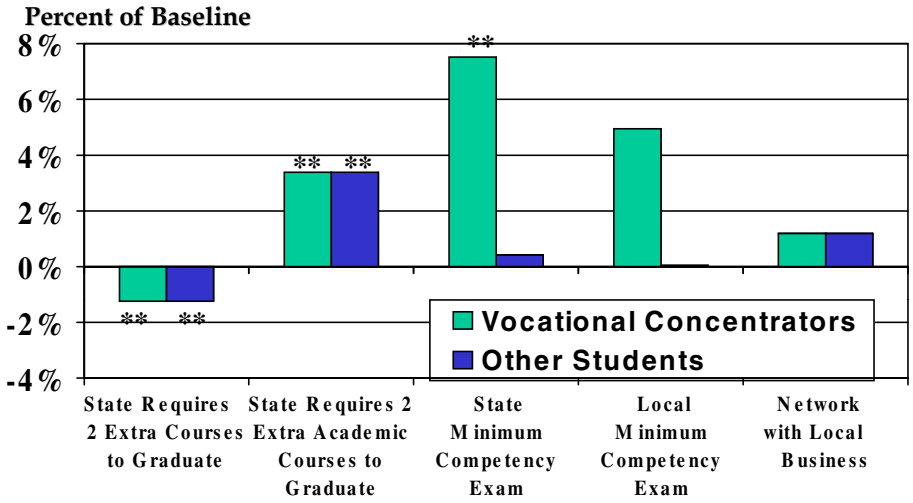
Source: Analysis of NELS:88 data on students who earn 15 to 32 Carnegie units--controls for attitudes, socio-economic status, courses taken, GPA & test scores in 8th grade, state & high school characteristics. Includes effects through changes in courses taken.

Figure 9—Total Effects of Graduation Requirements on Annual Earnings of Graduates by Vocational Status



Source: Analysis of NELS:88 data on HS grads who earn 15 to 32 Carnegie units--controls for attitudes, socio-economic status, courses taken, GPA & test scores in 8th grade, state & high school characteristics. Includes effects through changes in courses taken.

Figure 10—Total Effects of Graduation Requirements on Wage Rates of Graduates by Vocational Status



Source: Analysis of NELS:88 data on HS grads who earn 15 to 32 Carnegie units--controls for attitudes, socio-economic status, courses taken, GPA & test scores in 8th grade, state & high school characteristics. Includes effects through changes in courses taken.

The regressions control for when students graduated from high school and whether they attended college, so we are measuring the short run effects of graduation requirements on labor market success net of effects that operate through the probability of attending college. The control variables are described in Appendix A.

Effects of Course Taking Patterns: We begin by examining the effects of different types of high school courses on employment and wages immediately after graduation. Graduates who took many vocational courses did not work significantly more but nevertheless obtained higher wage rates and earned substantially more. Our regressions predict, for example, that a vocational concentrator with five occupational vocational courses (and 3 fewer academic courses) was paid 7.5 percent more per hour and earned 20 percent more per month and per year than someone with no occupational vocational courses. Graduates who took extra academic courses in high school were, by contrast, less likely to work after high school, were paid slightly less per hour and earned less per month. Art, music and personal use courses had no effects on labor market outcomes. Introductory vocational courses had no effect on employment, unemployment and wage rates and significant negative effects on earnings in 1993.

Effects of Minimum Competency Exams: Consistent with our earlier papers, we find once again that state minimum competency exams had positive effects on earnings of recent high school graduates in 1993 and 1994. The new finding is that these effects are, as we hypothesized, much larger for vocational concentrators than for non-concentrators. For example, state MCEs had no effect on employment and unemployment of non-vocational students, but they increased employment of vocational concentrators by 7 percent and decreased unemployment by 37 percent (see Figure 7 and 8). Annual earnings in states with MCEs were 9.5 percent higher for non-vocational students and 14.9 percent higher for vocational concentrators (see Figure 9). Wage rates were not significantly higher in MCE states for non-vocational students but were 8 percent higher for vocational concentrators (see Figure 10).[16]

None of the effects of local MCEs on labor market outcomes were statistically significant. But for a couple of outcomes, point estimates of coefficients are similar to those obtained for state MCEs. For example, vocational concentrators were paid 5 percent more per hour when they attended high schools with a local MCE; non-vocational students were paid only 0.5 percent higher.

Effects of Course Graduation Requirements: Holding academic course requirements constant, higher total course graduation requirements were associated with significantly lower wage rates and significantly lower 1994 earnings. A one Carnegie unit increase in total graduation requirements was associated with wage rates being 0.7 percent lower and 1994 earnings being 1 percent lower. Higher academic course graduation requirements had the opposite effect. Holding total course graduation requirements and actual course taking patterns fixed, a one unit increase in academic course requirements raised wage rates by 1.7 percent, raised 1994 earnings by 3 percent and lowered unemployment rates slightly. [17]

Other Determinants of Labor Market Outcomes: Other student characteristics that were associated with significantly lower monthly earnings or lower wage rates were: current attendance at college, female, African American, Asian, handicapped, rural location, Northeastern location, many siblings, and attending a school with a high incidence of free lunch. Monthly earnings were higher for students who had worked for pay in 8th grade, who had an internal locus of control and high self esteem and for students with parents who set tighter limits on behavior in 8th grade.

III. Summary and Policy Implications

The paper began with an examination of the effects of tougher graduation requirements on course taking patterns in high school. High school graduation tests reduced the number of occupational vocational courses taken by students and lowered their likelihood of becoming vocational concentrators. State MCEs increased academic course taking by C students but not by A students and B students. While these findings confirm some of our original hypotheses,

other findings contradict conventional wisdom and our initial hypotheses. Higher academic course graduation requirements increased academic course taking but did not decrease vocational course taking. Indeed, students in states with above average numbers of academic courses required for graduation took significantly more vocational education courses and were more likely to become vocational concentrators than students in states with low minimums. Another surprising finding was the positive effect of academic course graduation requirements and MCEs on the number of art, music, health and other personal interest courses taken. We doubt this is what policy makers had in mind when they established these policies. Why do minimum competency exams appear to increase personal interest course taking more than they increase academic course taking? What is it about higher academic course graduation requirements that results in students taking more personal interest courses? More research is needed on the impacts of individual components of state course graduation requirements on course taking, test score gains and other outcomes.

The paper then examined the determinants of test score gains between 8th and 12th grade in core academic subjects. Not surprisingly, gains were larger for students who took many academic courses and smaller for those who took introductory vocational courses. Occupational courses and personal interest courses had no effect on test score gains. Course graduation requirements and local option minimum competency exams had no effect (either direct or indirect) on learning during high school. State minimum competency examinations modestly increased learning by non-vocational students but not by vocational concentrators.

The next outcome examined was college attendance. Not surprisingly, the number of academic courses completed had a strong relationship with college attendance. Occupational vocational courses and personal interest courses also had significant positive relationships with college attendance but the magnitude of these effects was smaller than for academic courses. State and local minimum competency examinations had large significant positive effects on the college attendance rates of vocational concentrators but no effects on other students. State academic course graduation requirements, by contrast, had negative direct effects on college

attendance and positive indirect effects. When the two effects were combined, the net effect was close to zero. This implies that even though graduates who take extra academic courses in high school are much more likely to go to college, requiring students to take more academic courses by raising graduation requirements does not increase college attendance rates. In addition, when academic course requirements are held constant, the states with high total number of courses required to graduate have significantly lower college attendance rates.

Finally we examined the effect of course taking patterns and graduation requirements on labor market outcomes immediately after high school graduation. Holding college attendance constant, high school graduates who pursued a vocational concentration got higher wage jobs, were less likely to be unemployed and earned significantly more per month and per year than students who took no occupational vocational courses. Graduates who took above average numbers of academic courses were paid significantly less per hour, worked fewer months and earned less per month.[18] While wage rates were influenced by course taking patterns, the likelihood of receiving employer provided training was not.

Of the four types of graduation requirements evaluated, only two had positive effects on labor market outcomes immediately after high school. Increased state total course graduation requirements and local minimum competency examinations were not associated with better labor market outcomes. State minimum competency examinations, by contrast, were associated with dramatically improved labor market outcomes. Graduates from MCE states who did not do a vocational concentration earned 6 to 7 percent more per month and 9 percent more per annum than similar graduates in non-MCE states. Vocational concentrators benefited even more from growing up in a MCE state. In the 21 months after graduating they were one-third less likely to be unemployed, 8 percent more likely to be employed, paid 8 percent more per hour and earned 15 percent more per month. Employed graduates with vocational concentrations were also significantly more likely to get formal training when they lived in states with MCEs. Academic course graduation requirements also had a few positive effects. Holding total Carnegie unit graduation requirements constant, a one unit increase in academic

requirements raised wage rates by 1.7 percent and 1994 monthly earnings by 3 percent.

Policy Implications

Clearly the policy with the least to recommend it is increases in the total number of Carnegie units required to graduate from high school. Holding the number of academic courses required to graduate constant, graduates educated in states with high total course graduation requirements do not take and pass more academic courses, do not learn more during high school and do not earn more after high school. They are significantly less likely to go to college and are paid slightly less per hour when they work. In addition, Dean Lillard and Phillip DeCicca (2001) have found that dropout rates rise when states increase the number of courses students must take to graduate from high school.[19]

Variations in the number of elective and personal interest courses required account for most of the variance in the state set minimums for total numbers of courses required to graduate. In many cases, high course graduation requirements are the result of mandated electives and mandated art, music, health and physical education requirements. States should scale these requirements back. No state currently requires students to take more than 14 courses in the four core academic fields. Consequently the total number of courses required to graduate can be lowered without reducing the number of courses required in English, mathematics, science and social studies.

The policy with the most to recommend it is state minimum competency examinations. Test score gains by non-vocational students are somewhat higher in MCE states and vocational concentrators are more likely to go to college. Labor market outcomes are substantially better for both types of students in MCE states. On the other hand, state MCEs delay or prevent some students from graduating[20] and reduce the share of graduates who do a vocational concentration. The vocational concentrators who meet the higher academic standards, however, benefit greatly from the signal that MCEs sends to employers. Employers are in effect being told: "Vocational concentrators have both the occupational skills you seek and the academic skills you seek." The enhanced reputation of vocational concentrators makes them much more marketable. In our

view, these findings tend to support the heavy emphasis on combining rigorous academic coursework with specialization built around an occupational theme that characterizes the three best-known whole-school reform models for upper secondary education—High Schools that Work, Talent Development High Schools and Career Academies.

Appendix A

Variables Used In the NELS-88 Regressions

Dependent Variables

Labor Market Outcomes after High School:

Earns93: earnings in calendar year 1993.
Empltot: total number of months worked in the 21-month period from July 1992 to February 1994.
Unempltot: total number of months unemployed in the 21-month period from July 1992 to February 1994.
Incmonth: average monthly earnings when working.
Income94: monthly earnings in January/February 1994.
*Logwages***:** hourly wage rate in the last job held.
GoodJob: A zero-one dummy variable for job is not laborer, food service or retail sales worker.

Test score Gain Variables:

The IRT Theta "T" score was used because the restricted maximum likelihood models we were estimating assumed that the dependent variable has a normal distribution. An IRT Estimated Number Right, which is a non-linear transformation of the original theta scores was also available but it does not have a normal distribution while the Theta does. It has a mean of 50 and a standard deviation of 10 where the standardization was carried out on the weighted panel sample.

D8892mat: mathematics test score difference between 12^{th} grade and 8^{th}.
D8892eng: English test score difference between 12^{th} grade and 8^{th}.
D8892sci: science test score difference between 12^{th} grade and 8^{th}.
D8892soc: social studies test score difference between 12^{th} grade and 8^{th}.
D8892tot: average of the four tests score difference between 12^{th} grade and 8^{th}.
D8890tot: average of the four tests score difference between 10^{th} grade and 8^{th}.
D9092tot: average of the four tests score difference between 12^{th} grade and 10^{th}.
Hard2: an average of 10^{th} grade responses to "In each of your current classes [math, English, science and social studies], how often do you try as hard as you can." A response of "almost every day" was coded 4, "a few times a week" was coded 3, "about once a week" was coded 2, "less than once a week" was coded 1, and "never" was coded 0. Before averaging, answers for each subject were deviated from their means.

High School Completion and College Attendance Variables

Nodiplo: high school graduation status. Dummy variable indicating whether the student is in one of these situations (takes value = 1): enrolled in high school in 1994, working to get a equivalent high school diploma or not graduated and not working to obtain it.
Ged: high school graduation status. Dummy variable indicating whether (takes value=1) or not (takes value = 0) the student has received a GED or a certificate of attendance.
F2evdost: dummy variable indicating whether (takes value=1) or not (takes value = 0) the student ever dropped out over the whole period (1988-92).
College1: dummy variable indicating whether (takes value=1) or not (takes value = 0) the student was enrolled in any sort of postsecondary education institution during the fall semester of 1992.
College2: dummy variable indicating whether (takes value=1) or not (takes value = 0) the student was enrolled in any sort of postsecondary education institution during the spring semester of 1993.
College3: dummy variable indicating whether (takes value=1) or not (takes value = 0) the student was enrolled in any sort of postsecondary education institution during the fall semester of 1993.
College4: dummy variable indicating whether (takes value=1) or not (takes value = 0) the student was enrolled in any sort of postsecondary education institution during the spring

semester of 1994.

Control variables used in regression analysis

1. Grades, test scores and college attendance

Grades1: average of the self-reported grades in English, mathematics, science and social studies in 8th grade. Five points scale where mostly A's is 4, and mostly below D is 0.5.

Remedial: mean of two dummies measuring whether the student is attending at least once a week remedial English or remedial mathematics in 8th grade. Missing values were replaced by the mean of the variable.

Dumyreme: dummy variable with value =1 when remedial was missing.

Advanced: mean of four dummies measuring whether the student is attending at least once a week advanced, enriched or accelerated courses in English, mathematics, sciences or social studies in 8th grade. Missing values were replaced by the mean of the variable.

Dumyadva: dummy variable with value =1 when remedial was missing.

Tetamat: mathematics test score in 8th grade.

Tetaeng: reading test score in 8th grade.

Tetasoc: score on social studies test taken in 8th grade.

Tetasci: science test score in 8th grade.

Fulsem: sum of the percentages (ranging from 0 to 1) of months attending as a full-time student any postsecondary education institution in all semesters from fall 1992 to spring 1994. In every single semester 1 means that the student attended a college the whole period and 0 the opposite. Therefore, the maximum value is 4 and the minimum is 0.

Parsem: sum of the percentages (ranging from 0 to 1) of months attending as a part-time student any postsecondary education institution in all semesters from fall 1992 to spring 1994. In every single semester 1 means that the student attended a college the whole period and 0 the opposite. Therefore, the maximum value is 4 and the minimum is 0.

Fulsem93: sum of the percentages (ranging from 0 to 1) of months attending as a full-time student any postsecondary education institution in both the spring and fall semesters of 1993. In every single semester 1 means that the student attended a college the whole period and 0 the opposite. Therefore, the maximum value is 2 and the minimum is 0.

Parsem93: sum of the percentages (ranging from 0 to 1) of months attending as a part-time student any postsecondary education institution in both the spring and fall semesters of 1993. In every single semester 1 means that the student attended a college the whole period and 0 the opposite. Therefore, the maximum value is 2 and the minimum is 0.

Tottwful: sum of four dummy variables indicating whether the student was enrolled as a full-time student in a two-years postsecondary degree over the period fall 1992 - spring 1994.

Tottwpar: sum of four dummy variables indicating whether the student was enrolled as a part-time student in a two-years postsecondary degree over the period fall 1992 - spring 1994.

Twoful93: sum of two dummy variables indicating whether the student was enrolled as a full-time student in a two-years postsecondary degree over the period spring 1993 - fall 1993.

Twopar93: sum of two dummy variables indicating whether the student was enrolled as a part-time student in a two-years postsecondary degree over the period spring 1993 - fall 1993.

Twoful1: dummy variable indicating whether the student was enrolled as a full-time student in a two-years postsecondary degree in the fall semester of 1992.

Twopar1: dummy variable indicating whether the student was enrolled as a part-time student in a two-years postsecondary degree in the fall semester of 1992.

Semfu4: percentage (ranging from 0 to 1) of months attending as a full-time student any postsecondary education institution in the spring semester of 1994.

Sempa4: percentage (ranging from 0 to 1) of months attending as a part-time student any postsecondary education institution in the spring semester of 1994.

Semfu1: percentage (ranging from 0 to 1) of months attending as a full-time student any postsecondary education institution in the fall semester of 1992.

Sempa1: percentage (ranging from 0 to 1) of months attending as a part-time student any postsecondary education institution in the fall semester of 1992.

2. Geographic Region during high school

Urban1: dummy variable for school located in an urban community. Information from first follow-up (tenth graders).

Rural1: dummy variable for school located in a rural community (default is suburban). Information from first follow-up (tenth graders).

West1: dummy variable for school located in the west region. Information from first follow-up (tenth graders).

South1: dummy variable for school located in the south region. Information from first follow-up (tenth graders).

Central1: dummy variable for school located in the west region (default is Northeast). Information from first follow-up (tenth graders).

3. Personal characteristics

Black: dummy variable for being black, non-Hispanic.

Asian: dummy variable for being Asian.

Hispanic: dummy variable for Hispanic.

NatAmer: dummy variable for being Native American (default is white, non-Hispanic).

Handicap: dummy variable measuring in 1988 current or past participation in a program for the orthopedically handicapped or learning disabled. Information comes from the parents and teachers questionnaires. Note that the eligibility criteria and participation patterns used in NELS-88 tended to eliminate most severely handicapped students from the sample.

4. Family Background (all variables measured in 8th grade)

Ses88: composite created by NELS measuring the family socioeconomic status. They used father's and mother's education level and occupation and family income.

famsize: composite created by NELS estimating family size from both the parent and student questionnaires.

parinvol: variable measuring parents involvement in student school activities. It was created using two questions: how often student discuss with parents what is done in class and how often parents check on the student's homework. It runs from low values (checking often) to high values (not checking at all).

divor: household composition reported by the student. In this case the student lives with either the biological father or mother and, respectively, a female or male guardian.

single: household composition reported by the student. In this case the student only lives with either the biological father or mother.

other: household composition reported by the student. In this case the student lives with a relative or non-relative other than his/her father or mother (default is living with student's father and mother).

Books: dummy variable measuring whether (takes value =1) or not (takes value = 0) the student has at home more than 50 books.

Household religious background (information comes from parents questionnaire):

Misbaptist: dummy variable for having a Baptist religious background.

Misprote: dummy variable for parents being in any of other [non Baptist] Protestant denominations (e.g. Methodist, Lutheran, etc).

Miscatho: dummy variable for having a Catholic religious background.

Miscrist: dummy variable for having an eastern orthodox or other Christian religious background.

Misjewis: dummy variable for having a Jewish religious background.

Misother: dummy variable for having a Moslem, Buddhist, Hindu or other religious background.

misrelig: dummy variable which takes value = 1 when the answer is missing.

5. School Background (all variables measured in 1990 and provided by the principal)

Teacsal1: lowest salary paid to full-time teachers.
Catholi1: dummy variable for being a catholic school.
Privrel1: dummy variable for being a private religious non-catholic school.
Privnor1: dummy variable for being a non-religious and not ascertained school.
Perwhit2: percentage of white (non of Hispanic origin) students among tenth graders.
Perfree1: percentage of students over the total student body that receives free or reduced-price school lunch program.
Enrol90: tenth grade enrollment.
Enro90sq: square of the tenth grade enrollment deviated from the mean.
Meantes2: clustering students by 1990 high school, mean of the average (four items) test score obtained in 1988.
Meanses: clustering students by 1990 high school, mean of the family socioeconomic status in 1988.

6. Value Scores and Attitude Toward Work in 8th grade

Locus of control: psychological scale for locus of control.
Self Esteem: psychological scale for self-concept.
Totaltv: number of hours per day watching television. Missing values were replaced by the mean of the variable.
Dumytv: dummy variable with value =1 when totaltv was missing.
Readfun: number of hours per week the student read for fun. Missing values were replaced by the mean of the variable.
Dumyread: dummy variable with value =1 when readfun was missing.
Smoke: variable indicating student's smoking behavior, where 0 means not smoking at all, 1 means smoking between one to five cigarettes per day and 2 means more than half a pack per day.
Tothom: total number of hours spent on homework each week in all subjects.

7. Work Experience in 8th grade

Workhour: number of hours working for pay per week in student's present or more recent job.
Worksq: square of the number of hours working per week deviated from the mean.

Table 1
High Schools Requiring Passage of a Minimum Competency Exam to Graduate:

Proportion of Seniors Who Attend				
Socio-Economic Status		*Low*	*Medium*	*High*
	1980-2	.560	.503	.487
	1992	.647	.557	.442
Reading & Math Scores		*Low*	*Medium*	*High*
	1980-2	.547	.515	.466
	1992	.643	.565	.457

Source: Tabulations of HSB and NELS-88 principal survey responses weighted by the number of students sampled at the high school. Both surveys over sampled schools with large minority populations

Table 2
Effect of Graduation Requirements on Courses Taken in High School

	Mean (Standard Deviation)	State Minimum Comp Exam	Local Minimum Comp Exam	State Minimum Carnegie Units to Grad	Local Minimum Carnegie Units to Grad	Grade Point Average In 8th Grade	8tn Grade Test Scores	Socio-Economic Status	R Square RMSE
Introductory Vocational	.53 (.83)	.037 (.047)	.001 (.043)	.011* (.006)	.001 (.006)	-.060*** (.019)	-.122*** (.015)	-.112*** (.017)	.0694 0.876
Occupational Vocational	2.35 (2.03)	-.344*** (.117)	-.198* (.120)	.034*** (.013)	.053*** (.019)	-.274*** (.040)	-.327*** (.031)	-.374*** (.038)	.1637 1.873
Academic Courses	15.36 (3.11)	.030 (.134)	-.043 (.171)	.007 (.018)	.069** (.023)	1.104*** (.051)	.907*** (.040)	.583** (.043)	.4506 2.294
Other Courses	4.35 (2.12)	.304** (.136)	.483*** (.160)	.037** (.017)	.175*** (.025)	-.111*** (.039)	.022 (.032)	.115*** (.037)	.1452 1.971
Vocational Concentrator 0-1 dummy	.1387 (.346)	-.398** (.150)	-.156 (.188)	.022 (.018)	.069** (.028)	-.377*** (.055)	-.282*** (.049)	-.258*** (.059)	.0926

Source: Analysis of NELS:88 data. Sample is graduates of public high school who earned between 16 and 32 Carnegie units in high school. The MCE variable is a 1 for AL, FL, GA, HI, LA, MD, MS, NV, NM, NJ, NY, NC, SC, TN & TX. Models also contain a full set of student background variables measured in the 8th grade: family SES, books in the home, single parent, parents divorced, # of siblings, ethnicity, religion, gender, handicapping condition, test scores, GPA in 8th grade, hours watching TV, hours doing homework, Read for fun index, smoking, dummy for in advanced courses, dummy for in remedial courses, dummies for central city and rural, locus of control index, self esteem index and hours working for pay (plus it's square).). The following characteristics of the school the student attended during 10th grade (or had attended prior to dropping out) were also controlled: Catholic school, secular private school, private school controlled by a church other than the Catholic church, teacher salary, percent student body white, percent free lunch, mean 8th grade test score, mean family SES and enrollment per grade (plus it's square). The following characteristics of the state were controlled for: mean unemployment rate, mean weekly wages in retailing, payoff to completing high school, payoff to completing college and ratio of tuition to the retail wage and dummies for 4 Census regions. Models were not weighted. Numbers in parenthesis below the coefficient are Huber-White standard errors that correct for clustering by school.

\+ Statistically significant at the 10% level one a one tail test
* Statistically significant at 5% level on a one tail test
** Statistically significant at 5% level on a 2 tail test
*** Statistically significant at 1 % level on a 2 tail test.

Table 3
Effect of Graduation Requirements on Courses Taken in High School

	Mean (Standard Deviation)	State Minimum Comp Exam	SMCE on C-Student	SMCE on A Student	Local Minimum Comp Exam	LMCE on C- Student	LMCE on A Student	State Minimum Carnegie Units to Grad	Academic Courses Required to Grad	No Course Grad Req.	Grade Point Average In 8th Grade	8th Grade Test Scores	Socio-Econ Status	R Sq RMSE
Introductory Vocational	.53 (.83)	.009 (.048)	-.020 [.63]	.035 [.72]	-.009 (.043)	-.065 [.43]	.040 [.45]	.016** (.006)	-.003 (.014) [.39]	.038 (.076)	-.066** (.029)	-.122*** (.015)	-.109*** (.017)	.0697 0.879
Occupation-Vocational	2.35 (2.03)	-.433*** (.117)	-.61*** (.117)	-.277** [.030]	-.223* (.130)	-.48** (.018)	-.002 [.99]	.051*** (.015)	.057* (.030) [.0004]	.29 (.17)	-.358*** (.056)	-.324*** (.032)	-.375*** (.039)	.1646 1.877
Academic Courses	15.36 (3.11)	.118 (.137)	.356** [.047]	-.092 [.58]	.063 (.176)	.46** [.10]	-.29 [.23]	.027 (.019)	.124*** (.039) [.0004]	.72*** (.23)	1.229*** (.068)	.902*** (.041)	.571** (.044)	.4541 2.288
Other Courses	4.35 (2.12)	.319** (.149)	.35** [.044]	.28+ [.108]	.461*** (.164)	.796*** [.001]	.167 [.42]	.035* (.020)	.119*** (.037) [.0002]	-.24 (.21)	-.055*** (.039)	.019 (.033)	.124*** (.039)	.1279 1.996
Vocational Concentrator 0-1 dummy	.1387 (.346)	-.420*** (.147)	-.47** [.013]	-.38* [.053]	-.177 (.193)	-.44* [.06]	.058 [.83]	.027 (.020)	.076** (.037) [.007]	.01 (.24)	-.387*** (.074)	-.281*** (.050)	-.277*** (.060)	.0948 9246

Source: Analysis of NELS:88 data. Sample is graduates of public high school who earned between 16 and 32 Carnegie units in high school. The MCE variable is a 1 for AL, FL, GA, HI, LA, MD, MS, NV, NM, NJ, NY, NC, SC, TN & TX. Models also contain a full set of student background variables measured in the 8th grade: family SES, books in the home, single parent, parents divorced, # of siblings, ethnicity, religion, gender, handicapping condition, test scores, GPA in 8th grade, hours watching TV, hours doing homework, Read for fun index, smoking, dummy for in advanced courses, dummy for in remedial courses, dummies for central city and rural, locus of control index, self esteem index and hours working for pay (plus it's square).).
The following characteristics of the school the student attended during 10th grade (or had attended prior to dropping out) were also controlled: Catholic school, secular private school, private school controlled by a church other than the Catholic church, teacher salary, percent student body white, percent free lunch, mean 8th grade test score, mean family SES and enrollment per grade (plus it's square).
The following characteristics of the state were controlled for: mean unemployment rate, mean weekly wages in retailing, payoff to completing high school, payoff to completing college and ratio of tuition to the retail wage and dummies for 4 Census regions.
Models were estimated unweighted on 9246 observations.
Numbers in parenthesis below the coefficient are Huber-White standard errors that correct for clustering by school.

Table 4
The Effect of Minimum Competency Exams on Achievement Gains and Effort in High School

	Mean Gain (SD)	State Min Comp Exam	SMCE* Voc Concen-trator	SMCE on Voc Concen-trator	Local Min Comp Exam	LMCE* Voc Concen-trator	LMCE on Voc Concen-trator	State Min. Carnegie Units to Grad [Total]	Academic Courses Required to Grad	Reqire-ments In Subject	No course Grad Req.	Voc. Concen-trator	Voc. Courses	Acad. Courses	Other Course	Intro. Voc Courses	R2 # Obs.
Test Avg 8-12th Grade	7.90 (4.77)	.377+ (.250)	-.434 (.347)	-.06 [.89]	.014 (.243)	.555 (.465)	.57 [.22]	-.023 (.028)	.047 (.065) [.73]		.43 (.36)	-.08 (.28)	.011 (.052)	.379** (.029)	.023 (.029)	-.16** (.07)	.1215 7,884
Test Avg 10-12th Grade	3.58 (3.80)	.170 (.225)	-.124 (.294)	.046 [.90]	.014 (.236)	.508 (.421)	.52 [.24]	-.064** (.026)	.037 (.063) [.63]		-.40 (.35)	.29 (.24)	-.034 (.043)	.122*** (.023)	.013 (.024)	.030 (.061)	.0312 7,757
Test Avg 8-10th Grade	4.33 (4.11)	.207 (.217)	-.289 (.289)	-.08 [.81]	.061 (.248)	.554 (.49)	.61 [.21]	.034 (.025)	.020 (.058) [.36]		.82** (.33)	-.46 (.25)	.071+ (.045)	.281*** (.023)	.017 (.024)	-.20*** (.07)	.1062 8,919
Worked Hard	3.19 (.90)	.093*** (.036)	-.055 (.067)	.038 [.58]	.011 (.046)	-.072 (.102)	-.06 [.56]	-.002 (.005)	-.015+ (.010) [.12]		-.07 (.07)	.087+ (.06)	.006 (.010)	.031*** (.005)	.008+ (.006)	.001 (.017)	.0868 7,026
Science 8-12th Grade	7.42 (7.42)	.720* (.387)	-.958* (.559)	-.24 [.71]	.747* (.398)	.163 (.769)	.91 [.23]	-.034 (.045)	-.131 (.158) [.24]	.57 (47)	.29 (.55)	.26 (.45)	-.022 (.083)	.383*** (.047)	.042 (.044)	-.17+ (.12)	.0892 7,807
Math 8-12th Grade	8.69 (5.52)	.494* (.297)	-.348 (.370)	.146 [.74]	.240 (.290)	-.240 (.552)	.00 [.99]	-.057* (.033)	-.020 (.119) [.32]	-.15 (.31)	-.30 (.44)	-.19 (.31)	-.010 (.061)	.484*** (.035)	-.009 (.034)	-.29*** (.09)	.1311 7,859
Social Studies	9.51 (7.12)	.385 (.414)	.449 (.579)	.83 [.20]	-.63+ (.40)	1.48* (.83)	.85 [.31]	-.002 (.044)	.484*** (.162) [.29]	-.86* (.47)	1.07* (.60)	-.32 (.46)	-.074 (.083)	.286*** (.044)	-.008 (.047)	.02 (.12)	.0507 7,751
English 8-12th Grade	6.05 (7.11)	-.006 (.339)	-.580 (.507)	-.59 [.28]	-.496 (.373)	.768 (.768)	.27 [.71]	-.011 (.042)	-.035 (.110) [.64]	.20 (.39)	.39 (.50)	-.03 (.42)	.134* (.074)	.405*** (.042)	.056 (.045)	-.17+ (.11)	.0626 7,858

Source: Separate interaction for vocational concentrators. Sample is NELS:88 public school students who earned between 16 and 32 Carnegie units in high school. The dependent variables are the difference between a student's thetas (derived from the IRT scaling model) for grade t and her theta for grade t-2 or t-4. Dropouts were asked to take the 1990 and 1992 tests and are included in the data analyzed. In 8th grade cross-section data, the standard deviation of the Thetas is approximately 8.5 for all four of the tests. The MCE variable is a 1 for AL, FL, GA, HI, LA, MD, MS, NV, NM, NJ, NY, NC, SC, TN & TX. Models also contain a full set of student background variables measured in the 8th grade: family SES, books in the home, single parent, parents divorced, # of siblings, ethnicity, religion, gender, handicapping condition, test scores, GPA in 8th grade, hours watching TV, hours doing homework, Read for fun index, smoking, dummy for in advanced courses, dummy for in remedial courses, dummies for central city and rural, locus of control index, self esteem index and hours working for pay (plus it's square).). The following characteristics of the school the student attended during 10th grade (or had attended prior to dropping out) were also controlled: Catholic school, secular private school, private school controlled by a church other than the Catholic church, teacher salary, percent student body white, percent free lunch, mean 8th grade test score, mean family SES and enrollment per grade (plus it's square). The following characteristics of the state were controlled for: mean unemployment rate, mean weekly wages in retailing and in manufacturing and dummies for 4 Census regions. Models were not weighted. Numbers in parenthesis below the coefficient are Huber-White standard errors that correct for clustering by school. The numbers in brackets in the columns 4 and 7 are the p values for a hypothesis test that the MCE's effects on vocational concentrators are significantly different from zero.

+ Statistically significant at the 10% level one a one tail test * Statistically significant at 5% level on a one tail test

**** Statistically significant at 5% level on a 2 tail test *** Statistically significant at 1 % level on a 2 tail test**

Table 5
The Effect of Minimum Competency Exams on College Attendance

	Mean (SD)	State Min Comp Exam	SMCE* Voc Concen -trator	SMCE on Voc Concen-trator	Local Min Comp Exam	LMCE* Voc Concen-trator	LMCE on Voc Concen-trator	State Min. Courses to Grad [total]	Acad. Courses Require to Grad	No State Course Grade Req.	School Partners With Local Business	Voc. Concen-trator	Voc. Courses	Acad. Courses	Other Courses	Intro. Voc Courses	R2 # Obs.
Fall 1992	.622 (.485)	-.045 (.118)	.297* (.183)	.29* [.19]	.005 (.13)	.486+ (.308)	.48* [.12]	-.039*** (.015)	-.052* (.030) [.006]	-.012 (.17)	-.022 (.033)	-.30* (.16)	.082*** (.029)	.304*** (.016)	.083*** (.017)	-.033 (.042)	.2556 7,096
Spring 1993	.625 (.484)	-.038 (.113)	.257+ (.179)	.22 [.24]	-.045 (.134)	.142 (.266)	.10 [.70]	-.032** (.014)	-.040+ (.029) [.025]	.025 (.17)	-.015 (.034)	-.13 (.16)	.040+ (.028)	.288*** (.016)	.065*** (.017)	.029 (.042)	.2374 7,096
Fall 1993	.595 (.490)	.016 (.103)	.241 (.189)	.26+ [.18]	-.077 (.135)	.689** (.252)	.61** [.012]	-.024* (.015)	-.045+ (.029) [.031]	-.097 (.18)	-.009 (.032)	-.26* (.15)	.023 (.029)	.258*** (.017)	.039*** (.017)	-.026 (.043)	.2514 7,107
Spring 1994	.577 (.494)	.018 (.101)	.252+ (.177)	.26+ [.14]	-.032 (.126)	.299+ (.226)	.26 [.21]	-.041*** (.014)	-.054** (.028) [.003]	-.26+ (.17)	-.023 (.031)	-.21+ (.16)	.040+ (.029)	.249*** (.016)	.031** (.016)	-.063+ (.044)	.2477 7,105
Employer OJT	.140 (.347)	.268+ (.207)	.190 (.298)	.48 [.13]	-.076 (.205)	.166 (.431)	.09 [.83]	.001 (.026)	-.027 (.057) [.68]	-.093 (.36)	.076+ (.058)	-.27 (.28)	.043 (.048)	-.023 (.028)	.007 (.030)	.049 (.064)	.0513 2,841
Formal Training.	.244 (.429)	.294* (.159)	.077 (.232)	.37+ [.13]	-.084 (.170)	.515+ (.360)	.43 [.21]	-.002 (.020)	-.067+ (.041) [.125]	-.26 (.27)	.004 (.047)	-.37* (.22)	.057+ (.037)	.004 (.022)	-.007 (.027)	.021 (.052)	.0330 2,841

Source: Separate interaction for vocational concentrators. Sample is NELS:88 public school students who earned between 16 and 32 Carnegie units in high school. The MCE variable is a 1 for AL, FL, GA, HI, LA, MD, MS, NV, NM, NJ, NY, NC, SC, TN & TX. Models also contain a full set of student background variables measured in the 8th grade: family SES, books in the home, single parent, parents divorced, # of siblings, ethnicity, religion, gender, handicapping condition, test scores, GPA in 8th grade, hours watching TV, hours doing homework, Read for fun index, smoking, dummy for in advanced courses, dummy for in remedial courses, dummies for central city and rural, locus of control index, self esteem index and hours working for pay (plus it's square).). The following characteristics of the school the student attended during 10th grade (or had attended prior to dropping out) were also controlled: Catholic school, secular private school, private school controlled by a church other than the Catholic church, teacher salary, percent student body white, percent free lunch, mean 8th grade test score, mean family SES and enrollment per grade (plus it's square). The following characteristics of the state were controlled for: mean unemployment rate, mean weekly wages in retailing, payoff to college attendance, the ratio of tuition to the retail wage and dummies for 4 Census regions. Models were not weighted. Numbers in parenthesis below the coefficient are Huber-White standard errors that correct for clustering by school. The numbers in brackets in the columns 4 and 7 are the p values for a hypothesis test that the MCE's effects on vocational concentrators are significantly different from zero.

The approximate effect of X_i (at the mean of the dependent variable) on the probability of attending college can be obtained by multiplying β_i times P(1-P). Thus, for "Attending college in fall 1993 semester" the multiplier is .24.

\+ Statistically significant at the 10% level one a one tail test * Statistically significant at 5% level on a one tail test
** Statistically significant at 5% level on a 2 tail test *** Statistically significant at 1 % level on a 2 tail test

Table 6
The Effect of Minimum Competency Exams on Employment Outcomes after High School

	Mean (SD)	State Min Comp Exam	SMCE* Voc Concen-trator	SMCE on Voc Concen-trator	Local Min Comp Exam	LMCE* Voc Concen-trator	LMCE on Voc Concen-trator	State Min. Carnegie Units to Grad	Acad. Courses Require to Grad	Network With Local Business	Voc Concen-trator	Voc. Courses	Acad. Courses	Other Courses	Intro. Voc Courses	R2 # Obs.
1993 Annual Earnings	$5427 (5394)	515** (210)	293 (445)	808* [.070]	15 (267)	90 (660)	105 [.87]	-16 (29)	57 (60) [.50]	122* (65)	-418 (355)	258*** (59)	-55* (31)	-32 (34)	-170* (104)	.2737 6,032
Total Months Worked	14.15 (7.45)	-.09 (.36)	1.05** (.52)	.96* [.08]	-.20 (.36)	.56 (.77)	.36 [.64]	.008 (.040)	.083 (.087) [.31]	.14+ (.10)	-.33 (.45)	.09 (.08)	-.096** (.04)	-.02 (.04)	-.01 (.12)	.1444 7,059
Total Months Unempl.	1.47 (4.09)	-.034 (.161)	-.503* (.287)	-.54* [.06]	.187 (.171)	.025 (.43)	.21 [.61]	-.025+ (.018)	-.053+ (.042) [.059]	-.13** (.05)	-.02 (.24)	-.008 (.045)	-.021 (.022)	.017 (.023)	.01 (.07)	.0423 7,059
Average Earnings /mo	$528 ($505)	41.0** (17.6)	47.0 (37.7)	88.0** [.027]	15.7 (23.9)	-.7 (50)	15 [.77]	-1.6 (2.4)	5.3 (5.0) [.47]	7.5+ (6.0)	-35 (30)	24.0*** (5.2)	-4.5* (2.7)	.9 (2.9)	-5.5 (8.7)	.2367 6,949
Spring 1994 Earnings /mo	$517 ($642)	35.4+ (22.8)	56.2 (54.2)	81.6+ [.106]	7.1 (28.6)	-40.5 (67.5)	-33 [.62]	-5.0+ (3.3)	16** (6.5) [.092]	1.9 (7.9)	9 (43)	22.2*** (6.8)	-9.0*** (3.7)	4.4 (3.8)	-5.9 (12.2)	.2147 6,819
Log Hrly Wage Rate	1.292 (.556)	.011 (.023)	.071* (.042)	.082* [.052]	.004 (.032)	.047 (.066)	.053 [.42]	-.007** (.003)	.017*** (.006) [.14]	.006 (.007)	-.047 (.037)	.020*** (.006)	-.006* (.003)	.001 (.004)	-.00445 (.009)	.1014 7,001

Source: Analysis of NELS88. Interaction for vocational concentrators. Sample is public school students with 16 to 32 Carnegie units of course credit who were also interviewed in 1994. The MCE variable is a 1 for AL, FL, GA, HI, LA, MD, MS, NV, NM, NJ, NY, NC, SC, TN & TX. Models reported in this table contain controls for when the respondent got their high school diploma, whether the respondent was in college full time during spring 1994, whether she was a part-time student in spring 1994, the number of months spent attending college full-time and months spent attending part-time. Models also contain a full set of student background variables measured in the 8th grade: family SES, books in the home, single parent, parents divorced, # of siblings, ethnicity, religion, gender, handicapping condition, test scores, GPA in 8th grade, hours watching TV, hours doing homework, Read for fun index, smoking, dummy for in advanced courses, dummy for in remedial courses, dummies for central city and rural, locus of control index, self esteem index and hours working for pay (plus it's square).). The following characteristics of the school the student attended during 10th grade (or had attended prior to dropping out) were also controlled: Catholic school, secular private school, private school controlled by a church other than the Catholic church, teacher salary, percent student body white, percent free lunch, mean 8th grade test score, mean family SES and enrollment per grade (plus it's square). The following characteristics of the state were controlled for: mean unemployment rate, mean weekly wages in retailing and in manufacturing and dummies for 4 Census regions. Models were not weighted. Numbers in parenthesis below the coefficient are Huber-White standard errors that correct for clustering by school. The numbers in brackets in the columns 4 and 7 are the p values for a hypothesis test that the MCE's effects on vocational concentrators are significantly different from zero.

\+ Statistically significant at the 10% level one a one tail test * Statistically significant at 5% level on a one tail test
** Statistically significant at 5% level on a 2 tail test *** Statistically significant at 1 % level on a 2 tail test

Endnotes

[1] When a student moved to another state between 10th and 12th grade an average of the MCESTATE variables for 10th and 12th grade was used. When information on state was not available for 10th grade, residence in 12th grade was used and if that was missing as well, 8th grade residence was used. None of the states changed their policies during the 1990 to 1992 time period.

[2] Many of these schools were in California.

3 National Center for Educational Statistics, *The Digest of Education Statistics: 1993* (US Department of Education, 1993), p. 149.

[4] Robert Meyer, "Applied versus Traditional Mathematics: New Evidence on the Production of High School Mathematics Skills" Institute for Research on Poverty Discussion Paper 966-92 (1994), pp. 1-62.

[5] The coefficients on the four types of courses were translated into grade level equivalent (GLE) effects by dividing by an estimate of the test score gain during one year of school. GLE's were calculated by dividing the test score gains given in column 1 by four. Thus a GLE in science was 1.85 points, so the effect of one additional year of academic course taking was (.383/1.85) = .207 GLEs for science.

[6] John H. Bishop, Ferran Mane, Michael Bishop and Joan Moriarty, "The Role of End-of-Course Exams and Minimum Competency Exams in Standards-Based Reforms," Brookings Papers on Education Policy , 2001.

[7] The indirect effects of academic course graduation requirements [assuming total course graduation requirements to be fixed] operating through increases in academic course taking was calculated by multiplying the sum of the graduation requirements coefficients in column 10 of table 3 [.124] by the coefficient on academic courses [.379] in row 1 of Table 4 to get .047. The same was done for each of the other types of courses and for the vocational concentrator dummy and then summed. The resulting estimate of the indirect effect of a one-unit increase in state academic graduation requirements is .050. The direct effect was .047, so the total effect is 0.097 points on the composite test. Dividing by 1,975 puts the figure in a grade level equivalent metric, so the effect is .049 GLE.

[8] There were two exceptions to the generalization of identical sets of control variables. The state unemployment rates and weekly earnings in retailing were updated to 1992 and 1993. The payoff to completing high school was not included in the model.

[9] We calculated the size of the indirect effects of state and local MCEs on college attendance rates through the changes in course taking patterns they simulate. They offset one another to some extent and the net result was close to zero. Indirect effects on fall 1992 attendance were +0.5 percentage points for state MCEs and +0.4 percentage points for local MCEs.

[10] With the exception of adding the no graduation requirement dummy and the academic course requirements variable, the specification used in this analysis was the same as that used in John H. Bishop, Ferran Mane, Michael Bishop and Joan Moriarty, "The Role of End-of-Course Exams and Minimum Competency Exams in Standards-Based Reforms," Brookings Papers on Education Policy , 2001.

[11] M. H. Brenner. "The use of high school data to predict work performance," *The Journal of Applied Psychology,* Vol. 52, # 1, (1968), pp. 29-30.

Department of Labor, "General Aptitude Test Battery Manual" (Superinendent of Documents, 1970.)

John E. Hunter, James J. Crosson and David H. Friedman, "The Validity of the Armed Services Vocational Aptitude Battery (ASVAB) For Civilian and Military Job Performance" (Department of Defense, August 1985).

John Hartigan and Alexandra Wigdor, eds. *Fairness in Employment Testing* (Washington, D.C.: National Academy Press, 1989.)

John H. Bishop, "Impact of Academic Competencies on Wages, Unemployment and Job Performance," *Carnegie-Rochester Conference Series on Public Policy*, Volume 37, (December 1992), pp. 127-194.

[12] J. C. Hauser and Thomas M. Daymont, "Schooling, ability and earnings: Cross-sectional evidence 8-14 years after high school," *Sociology of Education*, Vol. 50 (July 1977), 182-206.
Paul Taubman and Terence Wales, "Education as an investment and a screening device," Education*, Income and Human Behavior,* ed. F. T. Juster, (New York: McGraw Hill, 1975), pp. 95-122.
Henry Farber and Robert Gibbons, "Learning and Wage Dynamics," *Quarterly Journal of Economics* (1996), pp. 1007-47.
Bishop, "Impact of Academic Competencies," pp. 127-194. [2nd reference; see n. 12]
Joseph Altonji and Charles Pierret, "Employer Learning and Statistical Discrimination." Forthcoming in Quarterly Journal of Economics

[13] CBS, (1990, September 6) "America's toughest assignments: solving the education crisis." New York.

[14] Jean Johnson, Ann Duffett, Tony Foleno, Patrick Foley and Steve Farkas, "Reality Check 2001" in Education Week, February 21, 2001, p. S1-S8.

[15] Monthly earnings were equal to total earnings divided by the number of months worked. If the individual did not work at all monthly earnings was set to zero. Thus the earnings variables are missing only when the individual says they worked but did not report how much they earned.

[16] We calculated the size of the indirect effects of state and local MCEs on labor market outcomes through the changes in course taking patterns they simulate. Vocational course taking declines and academic course taking rises. This results, for example, in a negative indirect effect of -$109 on 1993 annual earnings (about 2 percent of the mean) for state MCEs and -$65 for 1993 earnings for local MCEs.

[17] We calculated the size of the indirect effects of state total and academic course graduation requirements on earnings in 1993 through the changes in course taking patterns they simulate. They offset one another to some extent and the net result was essentially zero. For example, the indirect effects of a one unit increase in state academic course graduation requirements was $ 0.78 for 1993 earnings, $0.61 for average monthly earnings and $1.78 for monthly earnings in 1994.

[18] Ferran Mane's (1998) analysis of HSB and NELS:88 data got similar results. Ferran Mane, Economics of Education Review, Vol. 17,

[19] Dean Lillard and Phillip DeCicca, "Higher Standards, More Dropouts? Evidence within and across Time" (Forthcoming in *Economics of Education Review*, 2000), pp. 1-33.

[20] John H. Bishop, Ferran Mane, Michael Bishop and Joan Moriarty, (2001).