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ABSTRACT

In spring 1996, Arizona's Glendale Community College (GCC) undertook an evaluation of a microeconomics course using the national Test of Understanding in College Economics (TUCE III). Specifically, the study sought to determine how GCC student outcomes compared to national results on the TUCE III and if the microeconomics course made a statistical difference on student scores between the pre-course and post-course tests. The TUCE III pre-test was administered to students in two sections of the microeconomic course during the first week of class, while the post-test was administered as a final exam. Study results, based on outcomes for 30 students who took both the pre- and post-tests, included the following: (1) the mean pre-test score for GCC students was 10.70, significantly below the national norm of 12.35; (2) the mean score on the post-test for GCC students was 16.10, indicating that the course did make a significant difference in student TUCE III scores; (3) GCC students' mean post-test score was also not significantly different from the national mean of 16.67; and (4) although the TUCE III was found to provide valuable data, it was recommended that it not be used on a regular basis at GCC due to issues related to grading, the underrepresentation of community colleges in the national sample, and other issues. The test instrument, national pre- and post-test results, tables of score comparisons, and an examiners manual are appended. (TGI)

USING THE TEST OF UNDERSTANDING IN COLLEGE ECONOMICS (TUCE III) TO EVALUATE GCC'S MICROECONOMICS COURSE: AN ANALYSIS AND SUBSEQUENT ASSESSMENT

JUNE, 1997

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DATE: June 30, 1997

TO: Dean Alberto Sanchez

FROM: Michael C. Petrowsky

RE: Evaluation of the Microeconomics Principles Course (ECN 112) using the national Test of Understanding in College Economics (TUCE III)

Enclosed is a report that evaluates two microeconomics principles classes using the national Test of Understanding in College Economics (TUCE III). Both classes were given a standardized, national, norm referenced exam at the beginning and end of the Spring 1996 semester. These pre(course) test and post(course) test results were then analyzed using a variety of statistical techniques that included classical hypothesis testing, ANOVA, Chi Square analysis, and related nonparametric methods.

The results indicate that completion of the microeconomics course significantly raised TUCE III scores for GCC students. The continued use of the TUCE III as an ongoing evaluative instrument, however, remains problematic because of implementation difficulties.

I am indebted to you and to Paul DePippo for support in preparing this document. But any errors and omissions are clearly the fault of yours truly.

Michael C. Petrowsky

EXECUTIVE SUMMARY

Two classes in microeconomics principles (ECN 112) were evaluated using the national **Test of Understanding in College Economics** (TUCE III). For each of these classes, the TUCE III test was given at the beginning of the semester (first week) and the end of the semester as a final exam. A comparison of the precourse test results with the postcourse test results indicate that completion of the microeconomics course had significantly raised (in a statistical sense) the TUCE III scores for GCC students. Further, a breakdown of the TUCE III into content and cognitive components also showed that GCC students benefited in both areas as a result of course completion.

Despite these positive results, however, the TUCE III should not be used on an ongoing, routine basis. The costs of using the instrument may outweigh its benefits when seen from a community college perspective. The TUCE III could still be used on a nonroutine basis, though, to supplement other evaluative instruments.

CONTENTS

USING THE TEST OF UNDERSTANDING IN COLLEGE ECONOMICS (TUCE III) TO EVALUATE GCC'S MICROECONOMICS COURSE: AN ANALYSIS AND SUBSEQUENT ASSESSMENT

I. RATIONALE FOR STUDY

In 1991, the Joint Council on Economic Education (JCEE) published its third edition of the **Test of Understanding in College Economics** (TUCE III). Included with the test were norm referenced results that were based on the test being given to 1,426 students who took an introductory microeconomics course in 53 colleges and universities.

The test, along with its norm referenced results, was designed to aid in measuring course evaluation of the introductory microeconomics course at the college level. The measuring instrument could thus be used as a precourse and postcourse test. But it could also be used to compare a particular course at a given college with national norms.

The 33 question TUCE III is shown in Appendix A. The results of the nationwide test are in Appendix B. Pre and posttest scores are shown for the 1,426 students who answered all 33 questions on both the precourse test and the postcourse test. Also shown in Appendix B are mean scores in terms of number correct, percentile ranks, and T – scores as related to the raw score (number correct) in each category.

Given this wealth of information, a number of questions can be usefully raised vis-à-vis the students who take microeconomics at Glendale Community College (GCC). These concerns focus on the following:

1. Can the TUCE III be a measuring tool in GCC's evaluation efforts?
2. How do the students at GCC measure up to national standards in both the precourse and postcourse tests?
3. Can a GCC microeconomics course make a statistical difference between

precourse and postcourse test scores?

These issues determined the focus of the study.

II. SCOPE OF SURVEY

During the Spring of 1996, the TUCE III was administered to my two introductory microeconomics classes (ECN 112). The 33 question version of the TUCE III was given inasmuch as it included questions on international trade and finance. The precourse test was given during the first week of class. Students were given approximately 50 minutes to complete the exam. The postcourse test was used in lieu of a final exam.

For the two classes, the number of students surveyed included the following:

- 41 students had taken the precourse test.
- 32 students had taken the postcourse test.
- 30 students had taken both the pre and posttest

The fluctuating numbers here do pose a problem, but it is not insurmountable. The normal drops and adds during the first week of the semester are one factor. So, too, is the usual attrition that occurs during the semester. In any event, data for the 30 students that had taken both the pre and posttest will be used for purposes of this study, for this most closely conforms to the national data illustrated in Appendix B.

This pre and post data provide the raw information that is used in the survey. Because of this, several cautionary notes are in order. First, the survey is not random in

the statistical sense of the word. Problems are obviously generated in terms of wider interpretive validity.

Second, there may be a problem with the pretest data. While the posttest was treated as a final exam, the pretest carried no grade significance. There is thus the very real possibility that students may not have treated the pretest with the same intensity as the posttest. The nature and extent of this effect is not known. Yet it should be pointed out that this problem would have affected the national norms as well.

Finally, there is the limitation associated with sample size. As previously noted, 41 students from two microeconomics classes had taken the test, while only 30 students had taken both the precourse and postcourse test. This small size precludes making generalizations with strong assurance.

III. SURVEY RESULTS

A. AGGREGATE PRECOURSE & POSTCOURSE SCORES ON THE TUCE III IN MICROECONOMICS

Appendix C contains the raw data for the 30 students who had taken both the precourse test and the postcourse test. This data is summarized in Table 1 (below) which contrasts the GCC pre and posttest scores with national performance. (The scores are "raw" in the sense that they show the number of correct responses.)

TABLE 1

COMPARISON OF PRECOURSE AND POSTCOURSE MEAN SCORES* ON THE TUCE III (MICROECONOMICS) FOR GCC STUDENTS AND NATIONAL SURVEY

	PRETEST MEAN SCORE	POSTTEST MEAN SCORE	DIFFERENCE
GCC	10.70	16.10	5.40
NATION	12.35	16.67	4.32

*Scores indicate number of correct responses.

As can be seen from the data, the precourse test score for GCC students was 1.65 points below the national norm of 12.35. This was found to be statistically significant at the .05 level. The reason for this discrepancy is easily found by examining the surveyed schools that were utilized in the national study. For the 53 schools that participated, only five were two year colleges. The rest consisted of doctorate granting institutions, comprehensive universities and colleges, and four year colleges. This sample composition, then, probably accounts for the higher precourse national scores vis-à-vis GCC students.

Table 1 also contrasts the GCC precourse and postcourse mean test scores. While the GCC students had a mean score of 10.7 on the precourse test, the postcourse mean test score was 16.1 for a difference of 5.4 points. This difference was shown to be statistically significant at the .05 level as evidenced by the following statistical tests:

1. The difference between the GCC precourse and postcourse test means was subjected to classical hypothesis testing. The results are shown in Appendix D. The null hypothesis (that there was no difference) was rejected at the .05 level.
2. ANOVA was also used to test the difference between the GCC pretest and posttest means. The null hypothesis of no difference was rejected at the .05 alpha level (Appendix E).
3. The statistical significance between GCC pretest and posttest scores was also supported by Chi Square analysis (Appendix F).
4. Appendix G shows the results of the Wilcoxon Rank-Sum (nonparametric) test of the data. Again, the null hypothesis of no difference was rejected at the alpha .05 level.

From the above, it does appear that the microeconomics course did make a statistically significant difference in raising TUCE III mean scores. While the GCC mean posttest score is low (16.1 or 48.7 % correct), it is not different, in a statistically significant sense, from the national posttest mean of 16.67. The low scores, moreover, should be interpreted in the context that the TUCE III was designed as a norm referenced instrument with percentile ranks.

B. PRECOURSE & POSTCOURSE SCORES BY CONTENT AND COGNITIVE CATEGORIES IN MICROECONOMICS

1. Analysis of Pre & Post Cognitive Categories.

The previous section compared aggregate pretest and posttest data. The TUCE III, however, breaks the 33 questions down by content and cognitive categories. This breakdown is shown in Appendix H, which is a page taken from the TUCE III Examiner's Manual. Similarly, an explanation of the content and cognitive specifications are shown in Appendix I. On a somewhat simple level, the major difference between these two specifications is that while the content specifications emphasize general understanding in six topics, the cognitive specifications stress the ability to both explicitly and implicitly apply economic principles.

Appendix J shows the precourse and postcourse performance, by cognitive classification of questions, on the TUCE III in the national study. Once again, this has been taken from the TUCE III Examiner's Manual. Portions of this data (it also includes data for the macroeconomics course) have then been used to compare and contrast the national performance with GCC students. The results for the microeconomics course are shown in Table 2, where the cognitive categories (Recognition & Understanding, Explicit Application, and Implicit Application), are highlighted against pre and posttest columns for the GCC students and the national study. The numbers show the mean % correct in each cognitive specification.

TABLE 2

MEAN % CORRECT RESPONSES, BY COGNITIVE CATEGORY:
PRE & POSTTEST PERFORMANCE IN MICROECONOMICS FOR GCC STUDENTS AND NATIONAL STUDY

COGNITIVE CATEGORY	PRETEST		POSTTEST		QUESTIONS IN IN EACH
	National	GCC	National	GCC	
RU Recognition & Understanding	.353	.292	.486	.396	10
EA Explicit Application	.342	.268	.476	.497	12
IA Implicit Application	.429	.363	.555	.514	11
N	1426	41	1426	32	
MEAN	12.35	10.29	16.67	15.90	

Some qualifications regarding this data are in order. First, the small sample size for the GCC students meant that classical hypothesis testing for each category was probably not feasible. Second, and in an attempt to increase the sample size, the pretest n values for the GCC students include all those who completed the TUCE III, while the n values in the posttest include all those who had completed the posttest but not necessarily the pretest. The GCC data, then, are not exactly comparable to the GCC data used in the previous aggregate pre and post data section. This data is shown in Appendix K. Given these qualifications, the data in Table 2 were subjected to nonparametric (Wilcoxon Rank Sum) tests. The results indicated the following:

a. Appendix L compares the national precourse test cognitive data with that for

GCC students. There was found to be no significant difference at the .05 alpha level.

b. Appendix M compares the GCC precourse test cognitive data with the GCC posttest cognitive data. The null hypothesis (that there was no difference) was rejected at the .05 level.

c. The national postcourse test cognitive data was compared to the GCC postcourse test cognitive data. No significant difference was found at the .05 alpha level. (appendix N).

While the results here are preliminary and perhaps sketchy, there is some evidence to show that cognitive (critical thinking) skills are improved for GCC students when seen from the vantage point of pre and postcourse test data and national norms. The completion of a course in microeconomics did raise the number of correct responses in the three cognitive areas of recognition and understanding, explicit application, and implicit application.

2. Analysis of Pre & Post Content Categories in Microeconomics

As was indicated previously, Appendices H and I provide background material that explains the content specifications along with the six content areas. Unfortunately, the material provided in Appendix J for the national pre and posttest performance by cognitive classification was not available in the Examiner's Manual for the content

categories. Because of this, a comparison between GCC students and national norms could not be made. However, it was possible to compare the performance of GCC students in the content area using precourse and postcourse test data.

Table 3 (below) shows pre and postcourse test data for GCC students by the six content categories. These content areas are highlighted against pre and posttest columns for the GCC students. The numbers show the mean% correct in each content category.

TABLE 3

MEAN % CORRECT RESPONSES BY CONTENT CATEGORY:
PRE & POSTTEST SCORES IN MICROECONOMICS FOR GCC STUDENTS

CONTENT CATEGORY	PRETEST	POSTTEST	QUESTIONS
A. The Basic Economic Problem	.353	.539	4
B. Markets & the Price Mechanism	.3 10	.500	7
C. Costs, Revenue, Profit Maximization, and Market Structure	.200	.313	6.5
D. Market Failure, Externalities, Govt. Intervention & Regulation	.351	.480	6.5
E. Income Distribution & Government Redistribution	.349	.510	6
F. International Economics	.292	.572	3
SAMPLE SIZE	41	32	

Appendix O compares the mean pre and post course content scores using the Wilcoxon Rank Sum (nonparametric) test. Results indicate that the null hypothesis

(that there was no difference) was rejected at the .05 alpha level, thus generating support for the hypothesis that the ECN 112 course in microeconomics did improve performance in the six content areas. Similar results were obtained when another nonparametric test (Wilcoxon Signed Rank) was used. These results are shown in Appendix P.

Although individual content categories were not tested, it should be pointed out that the posttest scores were higher than the pretest scores in all content categories. The greatest gain appeared in the international economics area (61%), while the least gain showed up in the market failure category (36%). From all this, it seems apparent that significant improvement did occur for GCC students in general economic understanding that involved economic concepts.

IV. USING THE TUCE III IN MICRO: SOME CONSIDERATIONS

There are numerous advantages to using the TUCE III as an evaluative instrument in the microeconomics principles course. First, it does provide a wealth of information, and especially so in its breakdown of the test into cognitive and content categories. Second, norms have been developed on the national level that are most useful for assessing an individual school's performance. Needless to say, this adds an extra dimension to any evaluative effort.

But the use of the TUCE III has other, practical advantages as well. It has been developed as a standardized, generic test, with the consequent result that it is textbook

neutral. With over 20 microeconomics textbooks on the market, and with each of them having slight nuances in terms of coverage, jargon, political slant, etc., this is no small advantage, and makes faculty consensus on the choice of a testing instrument that much easier.

Finally, the TUCE III has a certain amount of built in flexibility which is also desirable. As an example, the three international trade questions have been conveniently placed at the end of both the microeconomics and macroeconomics versions of the test. Because the economics profession is rather split over where to teach international trade (with some favoring microeconomics over macroeconomics and vice versa), this gives the instructor a much needed flexibility, a flexibility which is made even easier by the development of a comprehensive Examiner's Manual which accompanies the test package.

Despite these advantages, however, the TUCE III does have its weaknesses when used at community colleges. First, and as was mentioned in Section III, community colleges were clearly underrepresented in the national study, with only five community colleges being surveyed out of a total of 53 colleges and universities. As we saw earlier, this under representation resulted in (statistically significant) lower precourse test scores for the GCC students.

Second, there is an emphasis in the TUCE III on application and policy questions that are both content and cognitive based. This may pose a problem for those instructors that eschew policy and applications because of value driven connotations. For these

instructors, the under emphasis given to pure theory and related mechanics may prove discomforting if not troublesome.

Third, there may be some problems involved in grading. Although the TUCE III does have the virtue of converting raw scores into percentile ranks, this may still be unsettling for those instructors that use other grading systems. Clearly, the use of the TUCE III might pose difficult – and perhaps insurmountable raw score/grade conversion problems - for many teachers not accustomed to norm referenced tests. Thus, a very real implementation quandary could be encountered if TUCE III was hastily used.

Fourth, there may be an unintended consequence in terms of student retention, student satisfaction, and the like. Because the TUCE III is very much textbook neutral, its use can be quite scary to the fledgling community college student who still heavily relies on the textbook and classroom notes.(I saw instances of this when I used the TUCE III as a final exam. Several students were visibly shaken and flustered.) For these students – and we do have many at our community colleges – any departure from classroom material is likely to produce high stress and anxiety. Although the effect of this on student retention is not known, it hardly seems positive.

Finally, there is a practical downside to using the TUCE III as a final exam evaluative instrument. If it is properly administered, it is designed as a 30 to 33 question test that should take less than an hour to complete. Yet our final exam time slots are normally two hours. In addition, many instructors may find that the test is simply not comprehensive enough. For these teachers, more questions would be needed.

For all these reasons, it is probably not feasible to use the TUCE III on an ongoing routine basis at community colleges. The quantitative, information generating virtues of the test are in all likelihood outweighed by the dysfunctional side effects previously noted. While this cost – benefit analysis has to be done at all colleges and universities, it appears likely that, at least for community colleges, the discomfort of using TUCE III may outweigh its advantages.

V. ANALYSIS OF FINDINGS & RECOMMENDATIONS

A. FINDINGS

1. Pretest scores for GCC students were (statistically) significantly lower than the pretest national norms developed on the TUCE III. This is probably due to bias generated by the under representation of community colleges in the national survey.
2. The GCC student mean post course scores were significantly higher than the mean precourse test scores when tested by classical hypothesis testing, ANOVA, Chi Square analysis, and nonparametric methods. The microeconomics principles course (ECN 112) did make a difference, then, in raising the TUCE III scores to a level statistically insignificant from posttest national standards.
3. When evaluated from TUCE III's cognitive and content categories, GCC students also showed statistically significant improvement as a result of taking a microeconomics course. Critical thinking skills, as well as general economic

understanding, did improve after course completion.

4. The use of TUCE III as an evaluative instrument was problematic at best. The cost of using the instrument may outweigh its benefits.

B. RECOMMENDATIONS

1. The TUCE III should probably not be used on an on going, routine basis. Rather, other evaluative instruments should be used that are more sensitive to the needs of community colleges.
2. The TUCE III can be used on a nonroutine basis to supplement other evaluative instruments. The national norms that were developed from the TUCE III give it a singular strength that is not easily dismissed.

NOTES

For a complete discussion of all background issues concerning the TUCE III, see Phillip Saunders, **Test of Understanding in College Economics: Examiner's Manual**. Joint Council on Economic Education, 1991. Third Edition.

TEST OF UNDERSTANDING IN COLLEGE ECONOMICS

MICROECONOMICS

THIS TEST IS AN IMPORTANT PART OF A NATIONAL EFFORT TO IMPROVE THE TEACHING OF INTRODUCTORY ECONOMICS.

YOUR INSTRUCTOR WILL INFORM YOU:

A. IF YOU SHOULD ANSWER ALL 33 QUESTIONS, OR IF YOU SHOULD ANSWER ONLY THE FIRST 30 QUESTIONS AND SKIP THE LAST 3;

B. IF YOUR SCORE ON THIS TEST WILL COUNT AS PART OF YOUR COURSE GRADE.

PLEASE DO YOUR **VERY BEST** TO CORRECTLY ANSWER ALL THE QUESTIONS ASSIGNED BY YOUR INSTRUCTOR.

1. **USE A PENCIL** to put your **NAME** and **SOCIAL SECURITY OR STUDENT I.D. NUMBER** on the **SEPARATE ANSWER SHEET**. **BLACKEN** in the appropriate circles under the letters of your name and **BLACKEN** in the appropriate circles under the numbers of your Social Security or student I.D. number.

2. For all questions assigned by your instructor, use the **SEPARATE ANSWER SHEET**, and select the **ONE BEST** answer for each question. Use **HEAVY** black marks that fill the circle completely to record your answer on the **SEPARATE ANSWER SHEET**.

EXAMPLES	IMPORTANT DIRECTIONS FOR MARKING ANSWERS
WRONG 1 ① ⊗ ③ ④ ⑤ WRONG 2 ① ② ✓ ④ ⑤ WRONG 3 ① ② ③ ④ ⑤ RIGHT 4 ① ② ③ ● ⑤	• Use #2 pencil only. • Do NOT use ink or ball point pen. • Make heavy black marks that fill the circle completely. • Erase cleanly any answer you wish to change. • Make no stray marks on the answer sheet.

3. Turn in **BOTH** the question sheets and the separate answer sheet after you have answered all the questions assigned by your instructor.

First edition 1967. Second edition 1980. Third edition 1991.

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1. Which of the following questions provides the best analogy to the basic economizing problem facing any nation? In a given factory:

   A. *shall* cars or tractors be produced?
   B. can the number of cars produced be increased?
   C. how fuel-efficient should the cars produced be?
   D. how many workers are required to produce 100 cars a week?

2. The Soviet constitution proclaims that no charge shall be made for use of water resources. From an economic standpoint, this is:

   A. efficient, since water is a free good provided at no cost by nature.
   B. inefficient, whenever using water for one purpose prevents its use for another purpose.
   C. an interesting difference from capitalism, but has no economic significance under socialism.
   D. a policy that increases the satisfaction people can get from their limited resources, since it makes goods like electricity and cotton, which are produced with water, cheaper.

3. If a firm must always sell its product at the market price, and wants to earn as much profit as possible, it should:

   A. produce the quantity of output at which marginal cost is minimized.
   B. keep marginal cost lower than price, so profits will be greater than zero.
   C. produce the quantity of output at which marginal cost has risen to equality with price.
   D. try to sell all the output it can produce, so that its fixed costs are spread across the largest possible number of units.

4. The basic economic objection to unregulated, profit-maximizing monopoly is that monopolists:

   A. do not try to minimize their costs of production.
   B. produce where marginal revenue is greater than marginal cost.
   C. produce too many products, which they sell at prices that are too high.
   D. restrict output and stop production at levels where their products are valued more than the marginal cost of producing them.

5. When estimating the costs of attending a university, a student demonstrates her economic knowledge by correctly including all the opportunity costs for her education. The items on her list include all but one of the following. Which one is *NOT* included?

   A. meals
   B. tuition
   C. reduced leisure time as a student
   D. income from a job she quit to attend school

6. If, at full employment, demand shifts toward the product of a capital-intensive industry and away from the product of a labor-intensive industry, which of the following is most likely to occur in the short run?

   A. Returns to both labor and owners of capital fall.
   B. Returns of both labor and owners of capital increase.
   C. Returns to labor increase, returns to owners of capital fall.
   D. Returns to owners of capital increase, returns to labor fall.

7. "More U.S. companies are taking advantage of falling oil prices resulting from increased output by switching to oil for fuel. This move is expected to depress coal prices and output."

   In terms of conventional supply and demand analysis, this situation is best described as a:

   A. shift in the demand curve for both oil and coal.
   B. movement along the demand curve for both oil and coal.
   C. movement along the demand curve for coal and a shift in the demand curve for oil.
   D. movement along the demand curve for oil and a shift in the demand curve for coal.

8. Suppose a city eliminates rent controls at a time when the vacancy rate for housing is extremely low. Which of the following is most likely to occur?

   A. No change in rents, since price controls are usually set where supply and demand curves intersect.
   B. A decrease in rents, followed by a decrease in the number of housing units supplied.
   C. An increase in rents, followed by an increase in the number of housing units supplied.
   D. An increase in the demand for housing, followed by a decrease in the number of housing units supplied.

9. If all of the firms producing a product in a perfectly competitive market are required to adopt antipollution devices that increase their cost of production, one would expect:

   A. the demand for the product to fall.
   B. the market supply curve to shift to the left.
   C. the long-run economic profits of the individual firms to fall.
   D. the short-run economic profits of the individual firms to remain unchanged.

10. Which of the following correctly describes an ***external benefit*** resulting from an individual's purchase of preventive medical services such as influenza or measles inoculations?

    A. Inoculations are cheaper than paying for treatment of disease.
    B. Doctors get more income because they charge for the inoculations.
    C. Inoculations reduce the likelihood of others catching the disease.
    D. Inoculations reduce sick days, allowing the individual to earn more income.

11. A monopoly is most likely to emerge and continue to monopolize its market when:

    A. firms have U-shaped average total cost curves.
    B. income elasticity of demand for its product is high.
    C. fixed capital costs are small relative to total costs.
    D. economies of scale are large relative to market demand.

12. If a government program of subsidized health care for the aged poor is established and paid for by an increase in the income tax, it would promote one economic goal but work against another. Specifically, these actions would be most likely to promote:

    A. security but reduce freedom.
    B. growth but reduce stability.
    C. stability but reduce security.
    D. efficiency but reduce equality.

13. Operating in the competitive labor market and the competitive product market of Sunshine City, one local frozen yogurt merchant finds that she can hire workers for $20 a day and sell each yogurt cone for $.50. She also compiles the following data relating the number of cones sold each day to the number of workers hired.

Total Employment (No. of Workers)	Total Output (No. of Cones Sold)	Total Revenue $
0	0	0
1	100	50
2	190	95
3	270	135
4	340	170
5	400	200
6	450	225
7	490	245
8	520	260

Given the information above, a profit-maximizing yogurt merchant would hire:

A. 1 worker.
B. 3 workers.
C. 5 workers.
D. 7 workers.

14. "Nobody has to tell me why ticket prices for professional sporting events are so high. The owners cannot afford to take the loss of the high salaries, so they just pass it on to the people like you and me." Is this statement most likely to be correct or incorrect? Why?

A. Correct. High sports salaries force owners to charge high ticket prices, which they can pass on to consumers because demand is elastic.
B. Correct. High sports salaries contain "economic rent" and economic rent normally gets passed on to consumers.
C. Incorrect. High sports salaries contain "economic rent" and would not be so high if the public were unwilling to buy tickets at the high prices.
D. Incorrect. Owners can afford to pay the high salaries without raising ticket prices. They raise prices simply to increase their marginal revenue above their marginal cost.

15. The country that produces 50 percent of the world's coffee limits its coffee exports in order to increase its income from sales abroad. Which of the following conditions would contribute the most to the success of this policy?

A. inelastic demand by coffee importers; inelastic supply by other coffee producers.
B. inelastic demand by coffee importers; elastic supply by other coffee producers.
C. elastic demand by coffee importers; inelastic supply by other coffee producers.
D. elastic demand by coffee importers; elastic supply by other coffee producers.

16. The derived demand for a factor of production would be expected to be relatively more elastic when:

A. there are no close substitutes for the factor.
B. the time period under consideration is very short.
C. the factor's cost is a large part of the total cost of production.
D. the demand for the product the factor is used to produce is inelastic.

17. The federal government once proposed that stricter standards be established for sulfur dioxide emissions. Since burning coal produces large amounts of sulfur dioxide, these new standards would have adversely affected firms that burned coal. The president of the United Mine Workers opposed the proposed standards on the grounds that they would "drive public utilities and other firms that burn large amounts of coal to nuclear reactors." This suggests that:

A. coal was cheap partly because users could avoid some of the cost of burning it.
B. government intervention would conceal the true economic advantages of cheap coal.
C. the sulfur dioxide standards, while well intended, were too strict to be economically practical.
D. miners would have preferred a tax on the use of coal rather than the sulfur dioxide standards.

18. A business firm has moved its offices to new quarters. It must continue to pay $3,000 a month for the old office space for six months; after that its lease will expire. If it succeeds in renting the old place, it will have to pay $1,000 a month for local utility services; otherwise 0. If the firm wants to lose as little as possible (or make as much money as possible), it should rent the old office space for as much as the market will bear provided the monthly rent is above:

A. $0.
B. $1,000.
C. $3,000.
D. $4,000.

19. "Public goods" are generally provided by government rather than private enterprise because:

I. the use of a public good by A reduces its usefulness to B.
II. the benefits of public goods cannot be limited to the persons who pay for them.

A. I only
B. II only
C. Both I and II
D. Neither I nor II

20. Government decisions that are more likely to suffer from the special-interest effect are ones that yield:

A. costs to all now and benefits to all later.
B. benefits to all now and costs to all later.
C. large benefits per member to a large group and small losses per member to a smaller group.
D. large benefits per member to a small group and small losses per member to a larger group.

21. There has necessarily been a change in the market demand schedule of a commodity if:

A. the production of the commodity has increased.
B. more of the commodity can be sold at the same price.
C. the commodity sells at a higher price than previously.
D. less of the commodity is being purchased than previously.

22. "The capacity to destroy the cities of a potential enemy is a necessary condition for keeping the peace, but the capacity to do it three times rather than two times adds little to our national security." In economic terms, this statement indicates that for such deterrence the:

A. marginal and total utilities are both low.
B. marginal and total utilities are both high.
C. marginal utility is low, but the total utility is high.
D. marginal utility is high, but the total utility is low.

23. "As a result of recent high coffee prices, increased demand for tea has given tea producers an economic profit at the present time." If the tea industry is a perfectly competitive industry, and if sufficient time were allowed for adjustment to the increased demand, what would one expect for the tea industry's:

	Output	Price	Economic Profit
A.	increase	fall	disappear
B.	increase	fall	increase
C.	decrease	rise	increase
D.	decrease	rise	disappear

24. "In market economies, long-run prices must cover rent, interest, and labor cost of production plus a profit return to the business owners. In socialist economies all natural resources and all capital goods are owned by the government. Hence, in socialist economies labor costs are the only costs of production, and goods can be sold at lower prices than in market economies. The lower prices of the socialist economies indicate that they are economically more efficient than market economies."

Is the conclusion essentially correct or incorrect?

A. Correct. The lower prices found in socialist economies indicate that basic goods like food and clothing are more widely available than in market economies. Therefore, the socialist economies are more efficient.
B. Incorrect. The relative efficiency of different forms of economic organization depends on the allocation of all scarce resources, not on prices that are assigned to resources.
C. Correct. The lower prices found in socialist economies indicate that the real cost of production in socialist economies is less than in market economies and that socialist economies are more efficient.
D. Incorrect. The higher prices which are found in market economies indicate that their output is more valuable than that of socialist economies. Therefore, market economies are more efficient than socialist economies.

25. In producing two goods (one with an external benefit, the other with an external cost), an unregulated competitive market would produce:

A. too much of both goods.
B. too little of both goods.
C. too much of the good with the external benefit, and too little of the good with the external cost.
D. too little of the good with the external benefit, and too much of the good with the external cost.

26. A state legislature increased the tax on beer sold within the state from $.50 to $.90 per gallon. A supporter said the tax would "tend to bring about more equality in the distribution of after-tax income within the state." This statement on the effect of the tax increase would be correct only if it could be shown that:

A. the quantity of beer purchased within the state is highly responsive to changes in its price.
B. people with small incomes tend to buy more beer each year than people with larger incomes.
C. people with large incomes tend to spend the same proportion of their incomes on beer each year as do people with smaller incomes.
D. people with large incomes tend to spend a larger proportion of their incomes on beer each year than people with smaller incomes.

27. "The effect of an excise tax on the products of pollution-producing industries will be a cutback in production. If the tax was levied directly on the amount of pollution generated, however. the long-run cutbacks in production would be much smaller." This statement is most likely to be:

A. false, provided the amount of the taxes on products and pollution is equal.
B. true, because firms would have a greater incentive to adopt new technology that causes less pollution.
C. false, because most firms would rather pay the tax than cut back production.
D. true, because taxes levied on pollution affect the demand curve; taxes on products affect the supply curve.

28. If a firm faces a demand curve that slopes downward to the right, we can reasonably expect that the firm:

A. must lower prices if it hopes to increase its profits.
B. will have no effect on the price of the product it sells.
C. will find that its marginal revenue is less than the price of the product it sells.
D. will find that its marginal revenue is greater than the price of the product it sells.

29. In an economy where there is unrestricted competition in all markets, coal is the primary source of heat for most households. Suppose a supply of natural gas which can provide heat at a much lower cost is discovered. What is the most likely effect of the natural gas discovery on the price of coal and the quantity of coal produced?

	Price	Quantity
A.	decrease	decrease
B.	decrease	increase
C.	increase	decrease
D.	increase	no change

30. "Deregulating the trucking industry is not the same as deregulating the airlines. Airlines have an expandable market–you lower rates and more people will travel. Trucking is different–anybody with a thousand pieces to ship is not going to ship any more just because the rates are lowered."

Which of the following economic principles casts doubt on the part of the quotation dealing with the trucking industry?

A. comparative advantage
B. upward sloping supply
C. downward sloping demand
D. specialization and the division of labor

31. The table below gives the number of tons of apples and bananas that can be produced in Country X and Country Y by employing the same amount of productive resources.

	Apples	Bananas
Country X	10	5
Country Y	8	2

The theory of comparative advantage, which is based on opportunity cost, implies that, under these conditions, **Country X** would find it advantageous to:

A. export apples and import bananas.
B. export bananas and import apples.
C. export both apples and bananas and import nothing.
D. import both apples and bananas and export nothing.

(Continued on page 8)

32. "To correct our balance of trade deficit, we should increase tariffs on imported goods." If tariffs are increased, the long-run effect is most likely to be:

A. a decrease in both U.S. imports and exports.
B. an increase in both U.S. imports and exports.
C. a decrease in U.S. imports, and an increase in U.S. exports.
D. an increase in U.S. imports, and a decrease in U.S. exports.

33. If the exchange rate between dollars ($) and yen (Y) changes from $1 = Y200 (Y1 = $.005) to $1 = Y100 (Y1 = $.01), and domestic prices in both countries stay the same, has the dollar appreciated or depreciated, and would U.S. imports from Japan become cheaper or more expensive?

	Value of the dollar	U.S. imports from Japan
A.	appreciated	cheaper
B.	appreciated	more expensive
C.	depreciated	cheaper
D.	depreciated	more expensive

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TABLE 12. Comparison of Pre- and Posttest Scores on Micro TUCE III for 1,426 Students Who Answered All 33 Questions on Both the Pretest and the Posttest

	Pretest			Posttest		
Raw Score	No. of Scores	Per-centile Rank	T-Score	No. of Scores	Per-centile Rank	T-Score
33	0	—	—	1	99	76
32	0	—	—	7	99	75
31	0	—	—	6	99	73
30	0	—	—	11	98	71
29	1	99	86	20	97	70
28	2	99	84	19	96	68
27	4	99	82	37	94	67
26	3	99	80	45	91	65
25	13	98	78	45	88	63
24	8	98	75	53	84	62
23	9	97	73	53	81	60
22	21	96	71	54	77	59
21	19	95	69	50	73	57
20	31	93	67	69	69	55
19	40	90	64	76	64	54
18	46	87	62	70	59	52
17	61	84	60	66	54	51
16	70	79	58	72	49	49
15	84	74	56	80	44	47
14	96	67	54	85	38	46
13	105	60	51	76	32	44
12	128	52	49	82	27	43
11	133	43	47	96	21	41
10	115	34	45	70	15	39
9	145	25	43	62	10	38
8	115	16	41	46	6	36
7	68	10	38	36	3	35
6	58	5	36	20	2	33
5	33	2	34	13	1	31
4	13	1	32	3	1	30
3	3	1	30	3	1	28
2	2	1	27	0	—	—
1	0	—	—	0	—	—
Mean Score			12.35			16.67
Std. Deviation			4.59			6.25
K-R 20 Coefficient			.68			.82
Std. Error of Measurement			2.59			2.62

APPENDIX B

Source: Examiner's Manual, TUCE III.

CBS-Descriptive Statistics 07-07-1996 - 12:08:04

Information Entered

Data Form: Raw
Number of Data Points: 30

	micpr		micpr		micpr
1 =	19	14 =	9	27 =	5
2 =	15	15 =	9	28 =	10
3 =	11	16 =	16	29 =	14
4 =	16	17 =	4	30 =	7
5 =	14	18 =	7		
6 =	6	19 =	11		
7 =	8	20 =	5		
8 =	14	21 =	5		
9 =	11	22 =	5		
10 =	19	23 =	6		
11 =	18	24 =	12		
12 =	12	25 =	7		
13 =	12	26 =	14		

Results

Mean:	10.7000
Median:	11
Mode:	5
Mode:	14
Range:	15
Variance (S):	20.2862
Standard Deviation (S):	4.5040
Coefficient of Skewness:	0.2296
Coefficient of Kurtosis:	1.8290

APPENDIX C

30 GCC Students Who Took the Pre Test

CBS-Descriptive Statistics I-MICPO 07-07-1996 - 12:15:30

Information Entered

Data Form: Raw
Number of Data Points: 30

	micpo		micpo		micpo
1 =	25	14 =	14	27 =	7
2 =	18	15 =	8	28 =	22
3 =	21	16 =	12	29 =	25
4 =	20	17 =	11	30 =	5
5 =	13	18 =	13		
6 =	12	19 =	11		
7 =	12	20 =	10		
8 =	16	21 =	12		
9 =	26	22 =	9		
10 =	23	23 =	9		
11 =	25	24 =	20		
12 =	31	25 =	11		
13 =	26	26 =	16		

Results

Mean:	16.1000
Median:	13.5000
Mode:	12
Range:	26
Variance (S):	47.4035
Standard Deviation (S):	6.8850
Coefficient of Skewness:	0.3884
Coefficient of Kurtosis:	1.8992

APPENDIX C

30 GCC Students Who Took the Posttest

CBS-Hypothesis Testing I-MICPRP 07-07-1996 - 14:58:32

Information Entered

Test Procedure:	Two Sided
Alpha Error:	0.0500
Critical Z (Test Statistic - alpha/2):	1.9600
Hypothesis Value:	0
Sample Size for Group 1:	30
Sample Size for Group 2:	30
Mean for Group 1:	10.7000
Mean for Group 2:	16.1000
Standard Deviation (S) for Group 1:	4.5040
Standard Deviation (S) for Group 2:	6.8850

	micpr	micpo		micpr	micpo
1 =	19	25	20 =	5	10
2 =	15	18	21 =	5	12
3 =	11	21	22 =	5	9
4 =	16	20	23 =	6	9
5 =	14	13	24 =	12	20
6 =	6	12	25 =	7	11
7 =	8	12	26 =	14	16
8 =	14	16	27 =	5	7
9 =	11	26	28 =	10	22
10 =	19	23	29 =	14	25
11 =	18	25	30 =	7	5
12 =	12	31			
13 =	12	26			
14 =	9	14			
15 =	9	8			
16 =	16	12			
17 =	4	11			
18 =	7	13			
19 =	11	11			

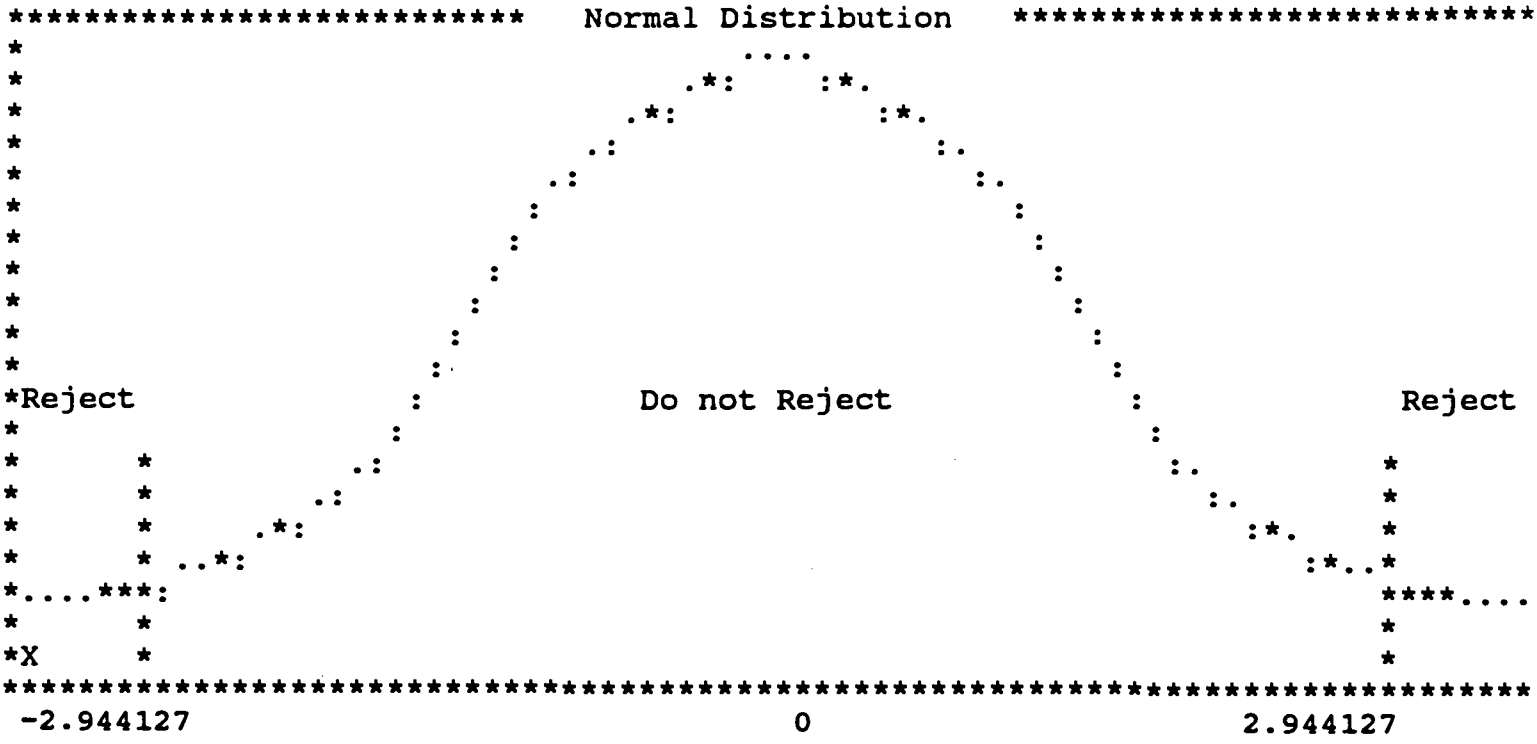
APPENDIX D

Hypothesis Testing of GCC Pre & Posttest Mean Scores

Results

Standard Error of Mean (unequal variances):	1.5021
Lower Limit:	-2.9441
Upper Limit:	2.9441
Standard Error of Mean (equal variances):	1.5021
Lower Limit:	-2.9441
Upper Limit:	2.9441
Mean 1 - Mean 2:	-5.4000
Degrees of Freedom:	58
Critical Z (Test Statistic - alpha/2):	1.9600
Computed Z (unequal variances):	-3.5950
p value:	0.0007

Conclusion: Reject Hypothesis


Normal Distribution
Reject
Do not Reject
Reject
-2.944127
0
2.944127

CBS-Analysis of Variance I-MICPRP 07-07-1996 - 12:35:15

Information Entered

Number of Variables:	1
Number of Columns:	2
Alpha Error:	.05

	micpr	micpo		micpr	micpo		micpr	micpo
1 =	19	25	13 =	12	26	25 =	7	11
2 =	15	18	14 =	9	14	26 =	14	16
3 =	11	21	15 =	9	8	27 =	5	7
4 =	16	20	16 =	16	12	28 =	10	22
5 =	14	13	17 =	4	11	29 =	14	25
6 =	6	12	18 =	7	13	30 =	7	5
7 =	8	12	19 =	11	11			
8 =	14	16	20 =	5	10			
9 =	11	26	21 =	5	12			
10 =	19	23	22 =	5	9			
11 =	18	25	23 =	6	9			
12 =	12	31	24 =	12	20			

Results

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Squared	Computed F-Value
Columns:	437.400	1	437.400	12.924
Error:	1,963	58	33.845	
Totals:	2,400.400	59		

Critical F (Col): 4.008 Reject Null Hypothesis

APPENDIX E
ANOVA for GCC Pre & Posttest SCores

CBS-Chi-Square Analysis I-MICPRP 07-07-1996 - 15:02:03

Information Entered

Number of Rows:	2
Alpha Error:	.025
Degrees of Freedom:	1
Critical chi-square:	5.02389

	micpr	micpo
1 =	27	18
2 =	3	12

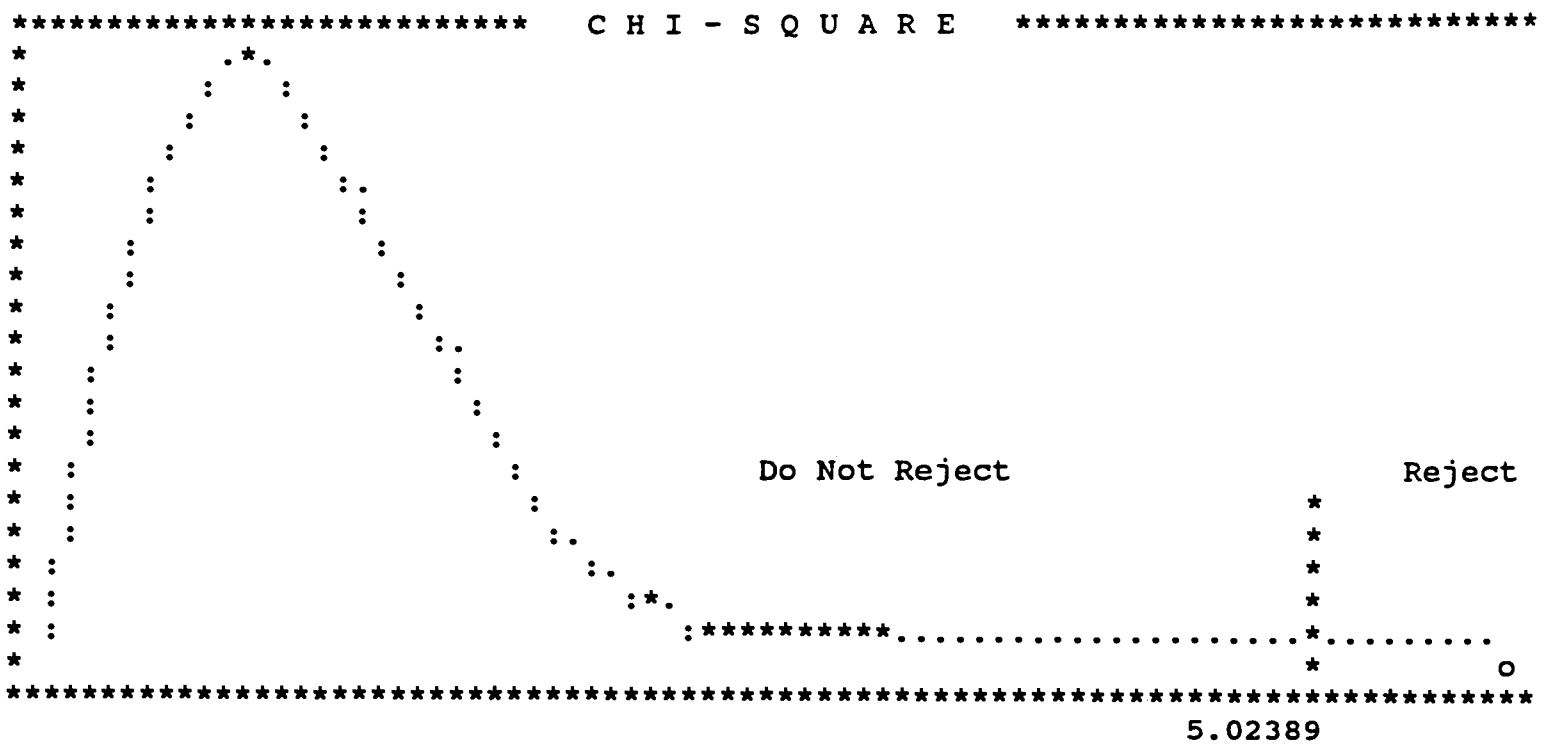
Results

Critical chi-square:	5.0239
Computed chi-square:	11.2500
p value:	0.0005

Conclusion: Reject Hypothesis

APPENDIX F

Chi Square Analysis of GCC Pre & Posttest Scores


C H I - S Q U A R E
Do Not Reject
Reject
5.02389

CBS-NonParametric Methods I-MICPRP 07-07-1996 - 13:50:56

Information Entered

Test Method: Wilcoxon Rank-Sum Test
Alpha Error: .05

	micpr	micpo		micpr	micpo		micpr	micpo
1 =	19	25	14 =	9	14	27 =	5	7
2 =	15	18	15 =	9	8	28 =	10	22
3 =	11	21	16 =	16	12	29 =	14	25
4 =	16	20	17 =	4	11	30 =	7	5
5 =	14	13	18 =	7	13			
6 =	6	12	19 =	11	11			
7 =	8	12	20 =	5	10			
8 =	14	16	21 =	5	12			
9 =	11	26	22 =	5	9			
10 =	19	23	23 =	6	9			
11 =	18	25	24 =	12	20			
12 =	12	31	25 =	7	11			
13 =	12	26	26 =	14	16			

Results

	r1	r2		r1	r2
1 =	48.5	56	17 =	1	23.5
2 =	41	46.5	18 =	10.5	34.5
3 =	23.5	52	19 =	23.5	23.5
4 =	43.5	50.5	20 =	4	19.5
5 =	38	34.5	21 =	4	30
6 =	7.5	30	22 =	4	16.5
7 =	13.5	30	23 =	7.5	16.5
8 =	38	43.5	24 =	30	50.5
9 =	23.5	58.5	25 =	10.5	23.5
10 =	48.5	54	26 =	38	43.5
11 =	46.5	56	27 =	4	10.5
12 =	30	60	28 =	19.5	53
13 =	30	58.5	29 =	38	56
14 =	16.5	38	30 =	10.5	4
15 =	16.5	13.5			
16 =	43.5	30			

APPENDIX G

Nonparametric Test of GCC Pre & Posttest Scores

Test Method:	Wilcoxon Rank-Sum Test
Alpha Error:	.05
Population Mean:	915
Standard Deviation:	67.6387
Sum of Group #1:	713.5000
Sum of Group #2:	1,116.5000
Standard Error:	132.5719
Critical Upper Limit:	1,047.5719
Critical Lower Limit:	782.4280

Conclusion: Reject Hypothesis

TABLE 2. Specification Matrix for 33-Item Micro TUCE III

Content Categories	Cognitive Categories			
	Recognition & Understanding	Explicit Application	Implicit Application	No. of Questions
A. The Basic Economic Problem	1	5	(2), (24)	4
B. Markets and the Price Mechanism	21	(7), 8, 9,* 15, (22), (30)*	29	7
C. Costs, Revenue, Profit Maximization, and Market Structure	4, 11, 28	9,* (23)	3, 18	6 1/2
D. Market Failures, Externalities, Government Intervention and Regulation	10, 19, 20, 25	(30)*	(17), (27)	6 1/2
E. Income Distribution and Government Redistribution	12	16, (26)	6, 13, (14)	6
F. International Economics		31, 33	(32)	3
Number of Questions	10	12	11	33

"Realistic" questions are circled.
No. of "Realistic" questions = 11. No. of times each alternative is correct: A = 8; B = 8; C = 8; D = 9
* Question 9 is classified 1/2 B and 1/2 C, and question 30 is classified 1/2 D and 1/2 B.

CONTENT SPECIFICATIONS

Macro

The content categories used to classify the macroeconomic questions are:

A. ***Measuring Aggregate Economic Performance*** (GNP accounting; "deflating" to distinguish between real and nominal dollar measures)

B. ***Aggregate Supply, Productive Capacity, and Economic Growth*** (productive resources, savings, investment, and productivity)

C. ***Income and Expenditure Approach to Aggregate Demand and Fiscal Policy*** ($C + I + G + (X - M) = GNP = P \cdot Q$, savings, investment, and the multiplier)

D. ***Monetary Approach to Aggregate Demand and Monetary Policy*** ($M \cdot V = GNP = P \cdot Q$, money, banking, expectations, and the velocity of circulation)

E. ***Policy Combinations*** (the monetary-fiscal policy mix, including automatic stabilization)

F. ***International Economics*** (balance of trade and balance of payments, tariffs, exchange rates)

Micro

The content categories used to classify the microeconomic questions are:

A. ***The Basic Economic Problem*** (scarcity, opportunity cost, and economic efficiency)

B. ***Markets and the Price Mechanism*** (basic supply and demand analysis including price elasticity, marginal utility)

C. ***Costs, Revenue, Profit Maximization, and Market Structure*** (marginal analysis, fixed cost, monopoly and competition)

D. ***Market Failures, Externalities, Government Intervention and Regulation*** (public goods, externalities, and inefficiencies of overregulation and underregulation)

E. ***Income Distribution and Government Redistribution Policies*** (factor markets and effects of taxes, transfers, and subsidies)

F. ***International Economics*** (comparative advantage, tariffs, exchange rates)

The main purpose of these necessarily broad categories is to ensure adequate coverage of the basic content of "typical" college principles courses so that the *total raw score* can be deemed to measure *general understanding* of basic economics principles. Individual questions on TUCE III often deal with more than one concept or principle, and this makes simple content classifications difficult. In cases where the correct alternative deals with a concept or principle in one category and incorrect alternatives deal with concepts or principles in other categories, we have generally classified the question in the category corresponding to the correct alternative. In three cases, however, the interaction between the alternatives and the situation posed in the stem was sufficiently complex to justify classifying the question in two different content categories (macro #9, and micro #9 and #30, as shown in Tables 1 and 2).

The heavy emphasis on application questions that has characterized all editions of the TUCE may give the broad content categories as described above the appearance of a somewhat stronger policy orientation than is typical in many principles courses. A detailed examination of individual questions, however, will reveal that the policy context is used to test knowledge of and ability to use underlying concepts and principles, not to support or oppose particular policy proposals or to advocate or oppose "intervention" or "fine-tuning" in general.

Individual questions in different content categories vary in difficulty and in their cognitive classification as explained below, so no attempt should be made to make sweeping generalizations about student knowledge of individual concepts or principles based on a single question or even a small number of questions. It is worth repeating that TUCE III is designed so that the *total raw score* can serve as a *general* measure of economic understanding and discriminate among individual students on the basis of their ability to understand and apply selected concepts and principles. If individual researchers or individual instructors find that the fixed-weight content specifications of these tests are not appropriate for their circumstances, they should use the detailed item analysis data discussed below to help interpret their results, or perhaps to modify the tests. Modifications of TUCE III, however, are likely to invalidate the usefulness of the national norming and reliability data discussed below.

APPENDIX I
Source: Examiner's Manual: TUCE III

COGNITIVE SPECIFICATIONS

As indicated above, all editions of the TUCE have sought to emphasize the *application* of basic concepts and principles. The chair of the original TUCE committee noted: "The test will emphasize the ability to apply economic principles to real problems, including issues of public policy" (Fels, 1967, p. 664). As indicated in Tables 1 and 2, two-thirds of the questions on TUCE III are classified as application questions, and roughly half of the application questions (10 macro questions and 11 micro questions) are classified as "realistic." A realistic question is defined as one that uses a quotation taken or adapted from an actual published source or a "manufactured" quotation that might easily have appeared in such a source. In three cases (macro #17 and #20, and micro #2), an actual situation is described in the stem without quotation marks being used.

The three broad cognitive categories used to classify questions on TUCE III are: Recognition and Understanding (RU); Explicit Application (EA); and Implicit Application (IA).[2] Each of these categories is further specified as follows:

(RU) Recognizes and Understands Basic Terms, Concepts, and Principles

1.1 Selects the best definition of a given economic term, concept, or principle

1.2 Selects the economic term, concept, or principle that best fits a given definition

1.3 Identifies or associates terms that have closely related meanings

1.4 Recalls or recognizes specific economic rules, e.g., an individual firm's profit is maximized at that level of output at which marginal cost equals marginal revenue

(EA) Explicit Application of Basic Terms, Concepts, and Principles

2.1 Applies economic concepts needed to define or solve a particular problem when the concepts are explicitly mentioned

2.2 Distinguishes between correct and incorrect application of economic concepts that are specifically given

2.3 Distinguishes between probable and improbable outcomes of specific economic actions or proposals involving no unstated assumptions

2.4 Judges the adequacy with which conclusions are supported by data or analysis involving no unstated assumptions

(IA) Implicit Application of Basic Terms, Concepts, and Principles

3.1 Applies economic concepts needed to define or solve a particular problem when the concepts are not explicitly mentioned

3.2 Distinguishes between correct and incorrect application of economic concepts that are not specifically given

3.3 Distinguishes between probable and improbable outcomes of specific economic actions or proposals involving unstated assumptions

3.4 Judges the adequacy with which conclusions are supported by data or analysis involving unstated assumptions

These definitions are very similar to the ones used on TUCE II, except that some questions on that test involved the ability to deal with extraneous information presented in the question stem. Complaints about the use of extraneous information in multiple-choice questions and the length of questions that included such information were sufficiently strong to persuade the committee to drop that skill from the specification criteria for TUCE III.

As with the content categories described above, there are some questions for which the cognitive classification is not completely clear-cut. Whether or not the mental processes used by students to answer these questions actually correspond to their cognitive classification cannot be known with certainty; and any question for which a student has seen the correct answer can become a memory or a recall question, regardless of its cognitive classification. Nevertheless, the main purpose of the overall cognitive specifications is to ensure, so

[2] As the detailed specifications in the text indicate, our "Recognition and Understanding" category is a combination of the first two categories in Bloom's *Taxonomy of Educational Objectives* (Bloom, 1956), and our "Explicit Application" and "Implicit Application" categories are refinements of the third category in Bloom's taxonomy. The six categories of Bloom's taxonomy are: Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation. As originally defined, only the first three categories of objectives can be tested with multiple-choice questions. The first edition of TUCE used the categories "Simple Application" and "Complex Application" (Fels, 1967, pp. 664–66) instead of the current "Explicit Application" and "Implicit Application."

far as is practically possible, that a large number of questions require students to go beyond memorization and recall. We think that under ordinary circumstances the total raw score on TUCE III can be a useful measure of a student's general ability to *understand* and *apply* economic terms, concepts, and principles.

It should be emphasized that there is no necessary or direct relation between the kind of thinking or kind of knowledge being tested and the difficulty of a particular question. As Table 4 indicates, there are hard questions and easy questions in each cognitive category. Both the hardest question (#10) and the easiest question (#16) on the macro posttest are classified as RU questions. On the micro posttest, the hardest question (#16) is classified as an EA question and the easiest question (#6) is classified as an IA question.

ITEM CONSTRUCTION

Three sample questions are shown below to illustrate each cognitive category, to indicate how individual test items are constructed on TUCE III, and to demonstrate how the detailed item analysis data presented in Tables 7, 9, 11, and 13 can be interpreted. The data following each sample question approximate overall mean performance on TUCE III and show the percentage of students in our norming samples selecting each alternative before (pre) and after (post) they took a principles of economics course; the point biserial correlation between the mean score of those selecting the correct alternative (shown in **boldface**) on that question and the mean score of the total norm group on the appropriate form of TUCE III (R_t); and the point biserial correlation between the mean score of those selecting the correct alternative on that question and the mean score of the total norm group on the other questions in the same cognitive category on the appropriate form of TUCE III (R_c).[3]

Macro Question #8. Content Category "C." Cognitive Category "RU."

In comparing an increase in government spending on goods and services to an increase in private investment spending, we can correctly say that in the short run:

A. they will both shift aggregate supply.
B. they will both shift aggregate demand.
C. government spending is inflationary; private investment is not.
D. government spending must equal taxes; private investment must equal saving.

Pre	*Post*
25%	17%
29%	**50%**
22%	15%
24%	18%
$R_t = .20$	$R_t = .38$
$R_c = .33$	$R_c = .44$

Micro Question #9. Content Categories "B" and "C." Cognitive Category "EA."

If all of the firms producing a product in a perfectly competitive market are required to adopt antipollution devices that increase their cost of production, one would expect:

A. the demand for the product to fall.
B. the market supply curve to shift to the left.
C. the long-run economic profits of the individual firms to fall.
D. the short-run economic profits of the individual firms to remain unchanged.

Pre	*Post*
11%	9%
39%	**56%**
36%	25%
14%	10%
$R_t = .33$	$R_t = .44$
$R_c = .43$	$R_c = .50$

Macro Question #25. Content Category "C." Cognitive Category "IA," "Realistic."

"I have promised to do everything in my power to reduce the federal deficit. That means reducing federal expenditures and, if necessary, increasing taxes. Under present conditions of full employment and steady prices, we can afford to bear the

[3]The formula for a point biserial correlation between an individual test item, g, and the total test score (R_t) is:

$$R_{X_g} = [\bar{X}_g - \bar{X}/S_x]\sqrt{P_g/Q_g}$$

where $\bar{X}_g$ = mean score of those answering item g correctly; $\bar{X}$ = mean score of the total test; S_x = standard deviation on the total test; P_g = proportion answering item g correctly; $Q_g = 1 - P_g$. The formula for R_c is the same except that $\bar{x}$ = mean score on all the items in the same cognitive category as g, and S_x = standard deviation on all the items in the same cognitive category as g.

TABLE 4. Pre- and Posttest Performance on TUCE III by Cognitive Classification of Questions

	Pretest			Posttest		
	Mean Raw Score	Mean % Correct	Range of % Correct on Individual Questions	Mean Raw Score	Mean % Correct	Range of % Correct on Individual Questions
Macro						
30 Questions*	9.18	30.6	12–52	14.31	47.7	20–78
10 RU	3.17	31.7	12–51	5.34	53.4	20–78
10 EA	3.56	35.6	21–52	4.94	49.4	36–61
10 IA	2.44	24.4	14–37	4.03	40.3	28–53
33 Questions**	10.57	32.0	12–52	15.15	45.9	19–75
11 RU	3.61	32.8	12–52	5.50	50.0	19–75
11 EA	4.02	36.5	22–51	5.30	48.2	36–57
11 IA	2.93	26.6	13–45	4.35	39.5	28–57
Micro						
30 Questions†	10.71	35.7	9–67	15.36	51.2	35–76
10 RU	3.40	34.0	16–58	4.96	49.6	36–69
10 EA	3.19	31.9	19–56	4.85	48.5	35–67
10 IA	4.11	41.1	9–67	5.54	55.4	38–76
33 Questions††	12.35	37.4	10–67	16.67	50.5	33–77
10 RU	3.53	35.3	17–59	4.86	48.6	36–69
12 EA	4.10	34.2	19–58	5.71	47.6	33–67
11 IA	4.72	42.9	10–67	6.10	55.5	37–77

* N = 2,724. Weighted Selectivity Index = 47.65
** N = 1,324. Weighted Selectivity Index = 44.12
† N = 2,726. Weighted Selectivity Index = 49.49
†† N = 1,426. Weighted Selectivity Index = 49.89

CBS-Data Base Management I-MICFL 07-07-1996 - 13:27:27

Information Entered

	micpr	mipof		micpr	mipof		micpr	mipof
1 =	13	25	17 =	12	12	33 =	12	
2 =	13	18	18 =	8	11	34 =	7	
3 =	19	21	19 =	9	13	35 =	14	
4 =	15	20	20 =	9	11	36 =	5	
5 =	11	13	21 =	16	10	37 =	10	
6 =	16	12	22 =	4	12	38 =	14	
7 =	14	12	23 =	7	9	39 =	7	
8 =	6	16	24 =	11	9	40 =	14	
9 =	8	26	25 =	6	20	41 =	7	
10 =	4	23	26 =	11	11			
11 =	6	25	27 =	7	16			
12 =	14	12	28 =	5	7			
13 =	11	31	29 =	5	22			
14 =	19	26	30 =	5	25			
15 =	18	14	31 =	6	5			
16 =	12	8	32 =	12	14			

APPENDIX K

Scores for all GCC students who took the TUCE III

CBS-Hypothesis Testing I-MICFL 07-07-1996 - 15:30:38

Information Entered

Test Procedure:	Two Sided
Alpha Error:	0.0500
Critical Z (Test Statistic - alpha/2):	1.9600
Hypothesis Value:	0
Sample Size for Group 1:	41
Sample Size for Group 2:	32
Mean for Group 1:	10.2927
Mean for Group 2:	15.9063
Standard Deviation (S) for Group 1:	4.2676
Standard Deviation (S) for Group 2:	6.7075

	micpr	mipof		micpr	mipof		micpr	mipof
1 =	13	25	20 =	9	11	39 =	7	
2 =	13	18	21 =	16	10	40 =	14	
3 =	19	21	22 =	4	12	41 =	7	
4 =	15	20	23 =	7	9			
5 =	11	13	24 =	11	9			
6 =	16	12	25 =	6	20			
7 =	14	12	26 =	11	11			
8 =	6	16	27 =	7	16			
9 =	8	26	28 =	5	7			
10 =	4	23	29 =	5	22			
11 =	6	25	30 =	5	25			
12 =	14	12	31 =	6	5			
13 =	11	31	32 =	12	14			
14 =	19	26	33 =	12				
15 =	18	14	34 =	7				
16 =	12	8	35 =	14				
17 =	12	12	36 =	5				
18 =	8	11	37 =	10				
19 =	9	13	38 =	14				

APPENDIX K

Scores for all GCC students who took the TUCE III

CBS-NonParametric Methods 07-09-1996

Information Entered

Test Method:	Wilcoxon Rank-Sum Test
Alpha Error:	.05

	natl	econ
1 =	0.353	0.292
2 =	0.342	0.268
3 =	0.429	0.363

Results

	r1	r2
1 =	4	2
2 =	3	1
3 =	6	5

Test Method:	Wilcoxon Rank-Sum Test
Alpha Error:	.05
Population Mean:	10.5000
Standard Deviation:	2.2913
Sum of Group #1:	13
Sum of Group #2:	8
Standard Error:	4.4909
Critical Upper Limit:	14.9909
Critical Lower Limit:	6.0091

Conclusion: Do not Reject Hypothesis

APPENDIX L
Comparison of National Precourse Cognitive Scores with GCC Students

CBS-NonParametric Methods 07-09-1996 - 1

Information Entered

Test Method:	Wilcoxon Rank-Sum Test
Alpha Error:	.05

	pre	post
1 =	0.292	0.396
2 =	0.268	0.497
3 =	0.363	0.514

Results

	r1	r2
1 =	2	4
2 =	1	5
3 =	3	6

Test Method:	Wilcoxon Rank-Sum Test
Alpha Error:	.05
Population Mean:	10.5000
Standard Deviation:	2.2913
Sum of Group #1:	6
Sum of Group #2:	15
Standard Error:	4.4909
Critical Upper Limit:	14.9909
Critical Lower Limit:	6.0091

Conclusion: Reject Hypothesis

APPENDIX M
Comparison of GCC Precourse Cognitive Scores with Postcourse Scores

CBS-NonParametric Methods 07-09-1996 0

Information Entered

Test Method:	Wilcoxon Rank-Sum Test
Alpha Error:	.05

	natl	econ
1 =	0.486	0.396
2 =	0.476	0.497
3 =	0.555	0.514

Results

	r1	r2
1 =	3	1
2 =	2	4
3 =	6	5

Test Method:	Wilcoxon Rank-Sum Test
Alpha Error:	.05
Population Mean:	10.5000
Standard Deviation:	2.2913
Sum of Group #1:	11
Sum of Group #2:	10
Standard Error:	4.4909
Critical Upper Limit:	14.9909
Critical Lower Limit:	6.0091

Conclusion: Do not Reject Hypothesis

APPENDIX N
Comparison of National Postcourse Cognitive Scores with GCC Students

CBS-NonParametric Methods 07-09-1996 - 1

Information Entered

Test Method: Wilcoxon Rank-Sum Test
Alpha Error: .05

	pre	post
1 =	0.353	0.539
2 =	0.310	0.500
3 =	0.200	0.313
4 =	0.351	0.480
5 =	0.349	0.510
6 =	0.292	0.572

Results

	r1	r2
1 =	7	11
2 =	3	9
3 =	1	4
4 =	6	8
5 =	5	10
6 =	2	12

Test Method: Wilcoxon Rank-Sum Test
Alpha Error: .05

Population Mean: 39

Standard Deviation: 6.2450

Sum of Group #1: 24

Sum of Group #2: 54

Standard Error: 12.2402

Critical Upper Limit: 51.2402

Critical Lower Limit: 26.7598

Conclusion: Reject Hypothesis

APPENDIX O

Comparison of Mean Pre & Post Content Scores for GCC Students using Wilcoxon Rank Sum Test

CES-NonParametric Methods 07-09-1996 - [illegible]

Information Entered

Test Method: Wilcoxon Signed-Rank Test
Alpha Error: .05

	pre	post
1 =	0.353	0.539
2 =	0.310	0.500
3 =	0.200	0.313
4 =	0.351	0.480
5 =	0.349	0.510
6 =	0.292	0.572

Results

	rank	diff
1 =	4	0.186
2 =	5	0.190
3 =	1	0.113
4 =	2	0.129
5 =	3	0.161
6 =	6	0.280

Test Method: Wilcoxon Signed-Rank Test
Alpha Error: .05

Population Mean: 0

Standard Deviation: 9.5394

Sum of Signed Ranks: 21

Critical Upper Limit: 18.6972

Critical Lower Limit: -18.6972

Conclusion: Reject Hypothesis

APPENDIX P

Comparison of Mean Pre & Post Content Scores for GCC Students using Wilcoxon Signed Rank Test

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