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ABSTRACT

As part of an effort to improve basic math instruction at Vocational-Technical Institute (T-VI) in New Mexico, a survey was conducted asking teachers, tutors, and instructional technicians to assess the importance of and student performance on 35 basic math competencies. Survey responses were then related to two national standards of mathematical literacy: the vocational standards of the Secretary of Labor's Commission on Achieving the Necessary Skills (SCANS) and the academic standards of the National Council of Teachers of Mathematics (NCTM). Study highlights included the following: (1) several skills seen as important by SCANS and NCTM were viewed as unimportant by teachers of math and math-related subjects, including "working together in groups to solve problems," "using calculators," "ability to estimate," "ability to use measuring tools and systems," and "ability to use simple statistical processes"; (2) though different departments at T-VI had different requirements and expectations, there seemed to be a core of basic mathematical skills that almost all respondents agreed were important; (3) tutors found the use of "dimensional analysis" as particularly important; and (4) some skills viewed as generally important by most respondents were not usually addressed in the math curricula at T-VI, such as "the ability to generalize problem solutions to new situations"; "ability to apply a variety of strategies to the solution of a problem"; "ability to communicate in the language of math"; and "possessing confidence in one's mathematical abilities." Based on study findings, it was recommended that the appropriateness of national standards to the local labor and academic market be investigated; that different developmental and preparatory math courses be developed for different vocational and academic departments; that instructors be acquainted with current thinking in math education; and that curricula, texts, and tests be reformed to reflect skills that industry, academe, and T-VI faculty deem important. Item results by group are included. (KP)

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PURPOSE OF PROJECT

This project began as a sense among many instructors and administrators at T-VI that student performance in basic mathematics is not as good as it could or should be. That feeling led to discussions about ways in which basic math instruction could be improved. It became obvious that a clear definition of what "basic math" actually is would be helpful in pursuing that goal. This project is an effort to provide that definition, and to answer several questions relating to it.

DESCRIPTION OF PROJECT

A survey was used to gather data for this project. It asked teachers, tutors and instructional technicians at T-VI to answer two questions about each of thirty-five items. The items were individual mathematics competencies deemed "basic" by the National Council of Teachers of Mathematics (NCTM) in its authoritative work *Curriculum and Evaluation Standards for School Mathematics* (1989). The questions were:

(A) **"How important is it that students entering your program or course be able to perform this skill?"** and

(B) **"How well does the average student currently entering your program or course actually perform this skill?"**

The responses provided for the "importance" question were (1) **vital**; (2) **useful**; (3) **unimportant**. The responses for the "performance" question were (1) **good**; (2) **fair**; (3) **none**. In other words, a skill or competency that received a score of "1" on the "importance" scale would be considered vitally important, while a skill receiving a score of "3" would be considered unimportant. On the "performance" scale, a skill that got a score of "1" would be performed well, while a score of "3" would indicate no performance. 371 surveys were distributed and 175 were returned, for a 47% response rate. The results of the survey are presented graphically in the pages following this introduction. Please refer to the following appendices for more information about the survey results:

Appendix A: Recipients, participation by group and procedure (discussion)
Appendix B: The survey
Appendix C: Item results by group (table)

NATIONAL STANDARDS

It is my intention to relate the data gleaned from this survey to two national standards of mathematical literacy, one vocational and one academic. The

vocational standards are from reports by the Secretary of Labor's Commission on Achieving the Necessary Skills (SCANS, 1991, 1992). The academic standards are from the National Council of Teachers of Mathematics' *Curriculum and Evaluation Standards for School Mathematics* (NCTM, 1989). What follows is a summary and brief discussion of those standards.

◆

The **SCANS Reports** attempt to identify the basic skills that employers expect from their workers and to suggest appropriate educational goals to meet those expectations. The studies view mathematical skill as one of several related basic abilities, like reading, writing and other communication skills. The reports state that increased competencies for workers are needed in the following five areas:

- **Resources:** [The worker] identifies, organizes, plans and allocates resources. (Examples of "resources" include time, team members, tools, materials, etc.)
- **Interpersonal:** Works with others on teams, teaches others, serves clients, exercises leadership, negotiates, and works with diversity.
- **Information:** Acquires, organizes, interprets, evaluates and communicates information.
- **Systems:** Understands complex inter-relationships and can distinguish trends and predict impacts, as well as monitor and correct performance.
- **Technology:** Works with a variety of technologies and can choose appropriate tools for tasks.

The SCANS reports distinguish between arithmetical and mathematical skills expected of a worker:

SCANS Arithmetical Skills: Perform basic computations; use basic numerical concepts such as whole numbers and percentages in practical situations; make reasonable estimates and arithmetic results without a calculator; and use tables, graphs, diagrams and charts to obtain or convey quantitative information.

SCANS Mathematical Skills: Approach practical problems by choosing appropriately from a variety of mathematical techniques; use quantitative data to construct logical explanations for real world situations; express mathematical ideas and concepts orally and in writing; understand the role of chance in the occurrence and prediction of events.

According to the SCANS reports, skills desired by employers go beyond mere facility with the mechanics of basic number operations. They also include knowledge of simple statistical concepts and mental computation strategies, and

emphasize problem-solving skills. Employer requirements as detailed by SCANS introduce new demands for communication skills with quantitative information, thus expanding the definition of "basic skills." Further, employers emphasize the need to develop integrative skills so that workers can prioritize their actions and draw on a range of abilities. (Gal, 1994)

Workplace numeracy requirements can be divided into four general areas:
Calculation may involve using estimation, mental arithmetic, pencil-and-paper, calculator or computer, as work circumstances require.
Measurement can involve not only direct measuring with instruments, but also setting machines which then do the measuring. Care and accuracy are required, and an understanding of tolerances and ranges.
Handling Data in the workplace often implies interpreting what a worker sees on a computer screen an using a keyboard to react to it. Other data appears as graphs, charts or blueprints.
Problem-Solving usually includes the other areas, but has its own characteristics. Problem-solving at work involves making judgements. It often is a shared activity, requiring communication, teamwork and analysis of information in various formats. Consider the following common workplace problem-solving scenarios:

- Statistical Process Control is a way of monitoring the production of a machine while it is in operation, and making adjustments in order to maintain a standard of production. It involves *sampling, measuring, recording data, statistical analysis*, and *graphing*. Workers must then use this information to solve the problem of how to adjust the machine.
- A Customer Service Representative must often pull up a customer's records on a computer screen, evaluate the information shown there, and make a decision based on the customer's payment history. This involves evaluating information against a set of standards or rules, calculating effects of the application of the rules, and making a judgement.
- Quality-Assurance Teams are often used in high-performance workplaces to identify problems, set new productivity goals, and evaluate the results of various stages of production. Team members may use *graphs* to synthesize information about production processes; they may work together to offer *problem-solving* suggestions to overcome difficulties; *calculations* and *estimates* would be made; *records* and *measurements* would be collected and compared; *data* would be analyzed in order to make *collective decisions*. (Miculecky, 1994)

◆

NCTM'S *Curriculum and Evaluation Standards for School Mathematics* outlines the mathematical content students in elementary and high school should be expected to master. In the five years since these *Standards* were published, they have made a major impact in the United States and Canada. Almost all school textbooks published since 1990 include references to the *Standards* and have activities designed to meet them. Recent news reports indicating that few students are meeting expectations are based on expectations created by the *Standards*. (Kloosterman, 1994) Even though work is proceeding on standards specifically designed for community college students, I feel the *Standards for School Mathematics* are appropriate for our purposes, since one goal of this project is to find out what skills are basic for students entering T-VI programs. Even though the work contains many standards for specific skills (including those from which the project survey was drawn), **four standards** underlie all the others and comprise the core of the NCTM recommendations :

- **Problem Solving:** When students finish high school, they should be able to "(a) use problem-solving approaches to investigate and understand mathematical content, (b) apply integrated mathematical problem-solving strategies to solve problems from within and without mathematics, (c) recognize and formulate problems from situations within and without mathematics, and (d) apply the process of mathematical modeling to real-world situations." Translation: Students should be able to figure out problems that are a lot more complex than those found in the typical basic math book.
- **Communication:** Students are expected to express the thinking they use to solve a problem both verbally and in writing. They are also expected to understand and respond to the methods described by their peers.
- **Mathematics as Reasoning:** This standard involves having students make and test conjectures, formulate counterexamples and follow logical arguments.
- **Mathematical Connections:** Students must see connections between various mathematical ideas and between in-school and out-of-school mathematics. In other words, students must see how the mathematics they are learning can be applied to solve real problems.

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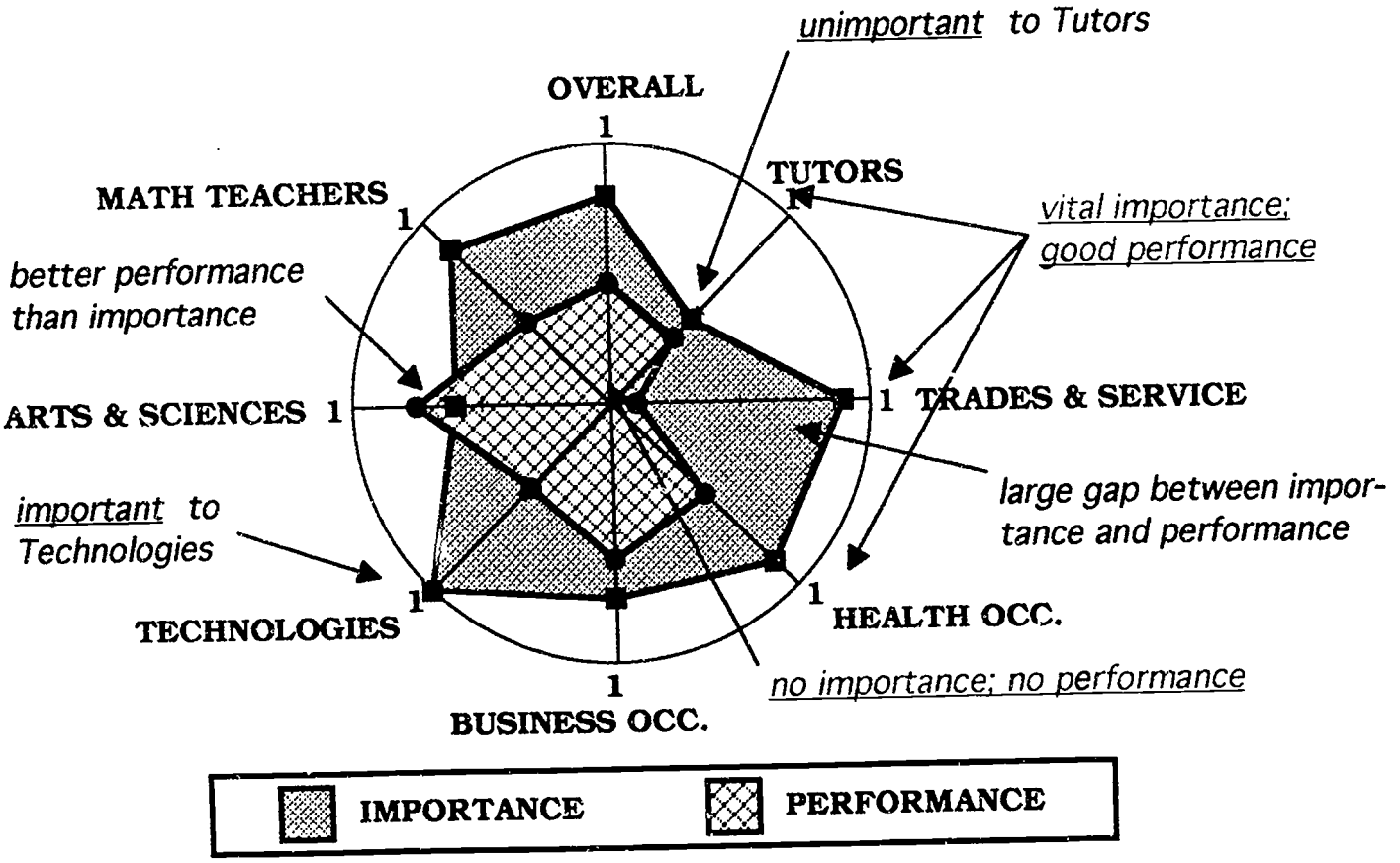
These vocational and academic standards for basic mathematical skills should be kept in mind and referred to as the charts on the following pages are examined.

EXAMPLE: How to read the charts



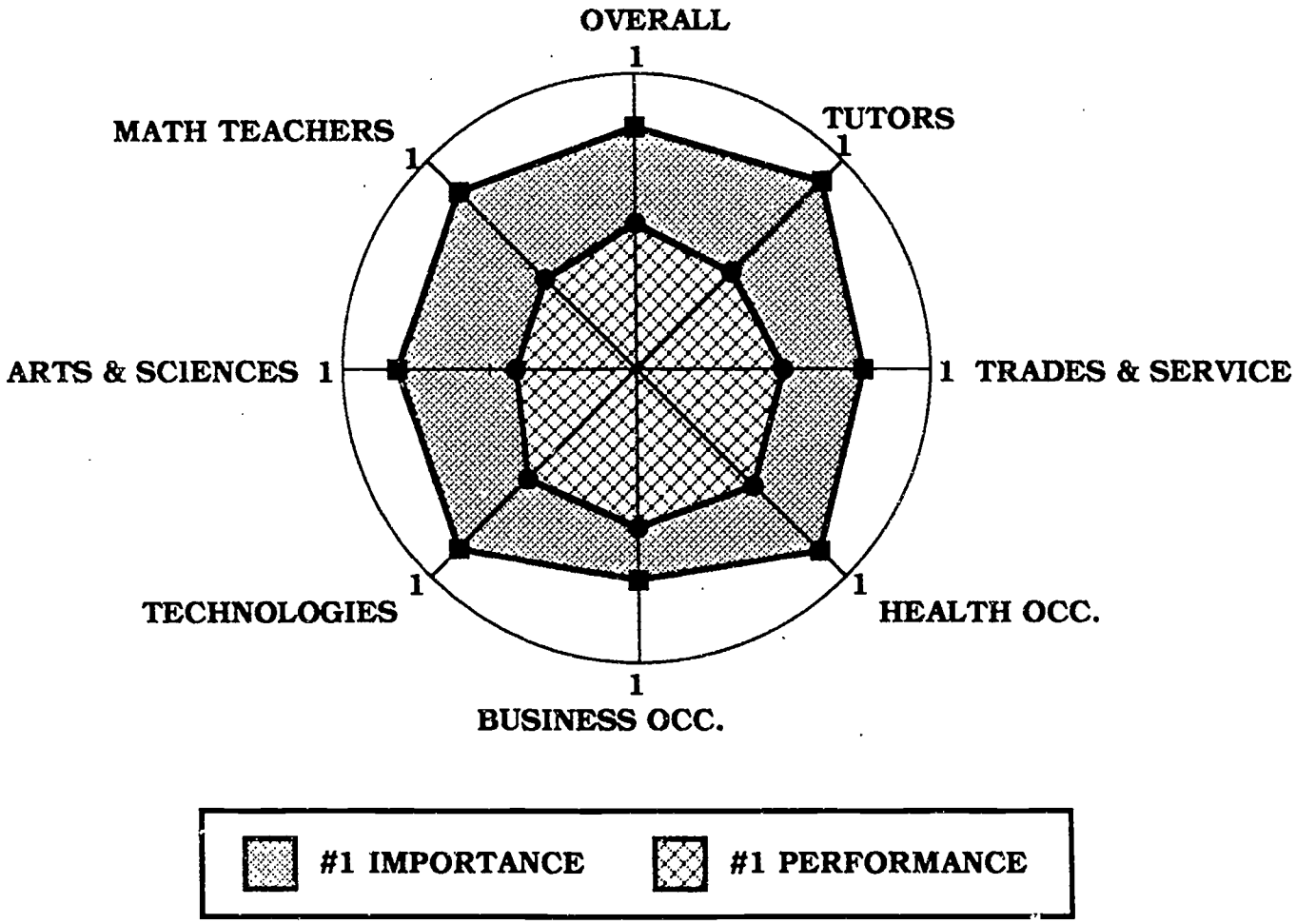
The 35 graphs which follow this sample page show the responses of certain T-VI instructors, tutors and instructional technicians to the following two questions:

A. How important is it that students entering your program or course be able to perform this skill?

B. How well does the average student currently entering your program or course actually perform this skill?

Each skill is listed at the top of its page. The "spider" chart is read like this: The number "1" on each axis means "vital" importance and "good" performance. The center point of the graph is "3", which represents no importance and no performance. So, the closer the dark-colored pattern is to "1," the more important the skill is perceived to be. Similarly, the closer the lighter pattern is to "1," the better the skill is performed. A large difference between the two points on an axis indicates a large disparity between importance and performance of the skill among that T-VI group. In this sample graph, the skill is most important to Technologies, because the dark pattern reaches all the way to "1" on the "Technologies" axis. The skill is least important to the tutors, since the dark pattern is farthest away from "1" along the "tutors" axis. The greatest disparity between "importance" and "performance" is shown by Trades, because the gap between the two points on the "Trades" axis is the largest. In this sample graph, Arts & Sciences views the performance of the skill as greater than its importance, since the light "performance" pattern is closer to "1" than the dark "importance" pattern.

SKILL #1: Ability to set up problems with the appropriate operations

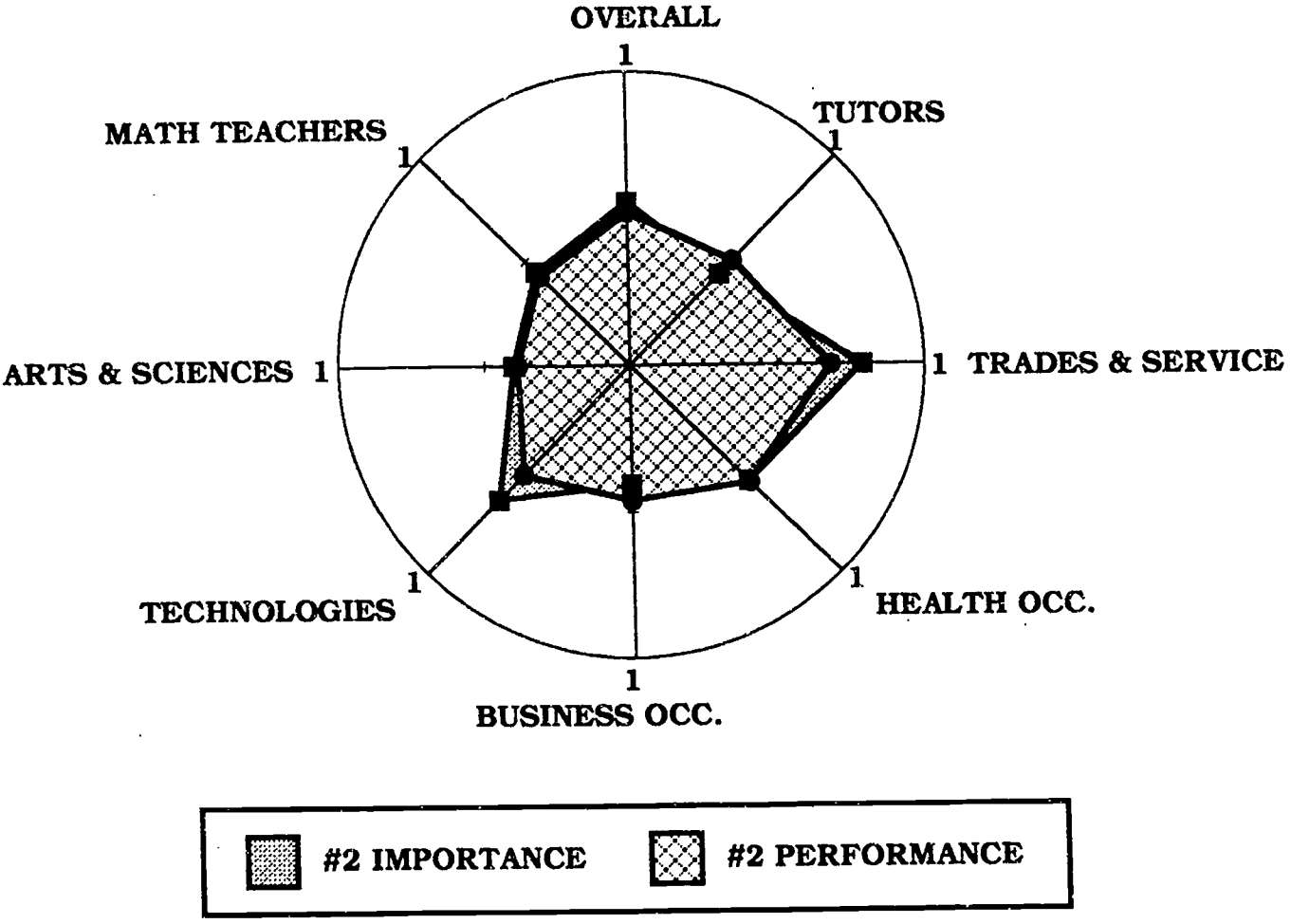


1. The closer the dark pattern is to "1," the more important the skill.
2. The closer the light pattern is to "1," the better the skill is performed.
3. The larger the gap between the two points on an axis, the greater the disparity between "importance" and "performance."

This skill is most important to: TUTORS
This skill is least important to: BUSINESS OCCUPATIONS
Greatest difference between "importance" and "performance:" ARTS & SCIENCES

Note: This skill is generally viewed as important by all groups.

SKILL #2: Ability to work with others in a group to solve problems



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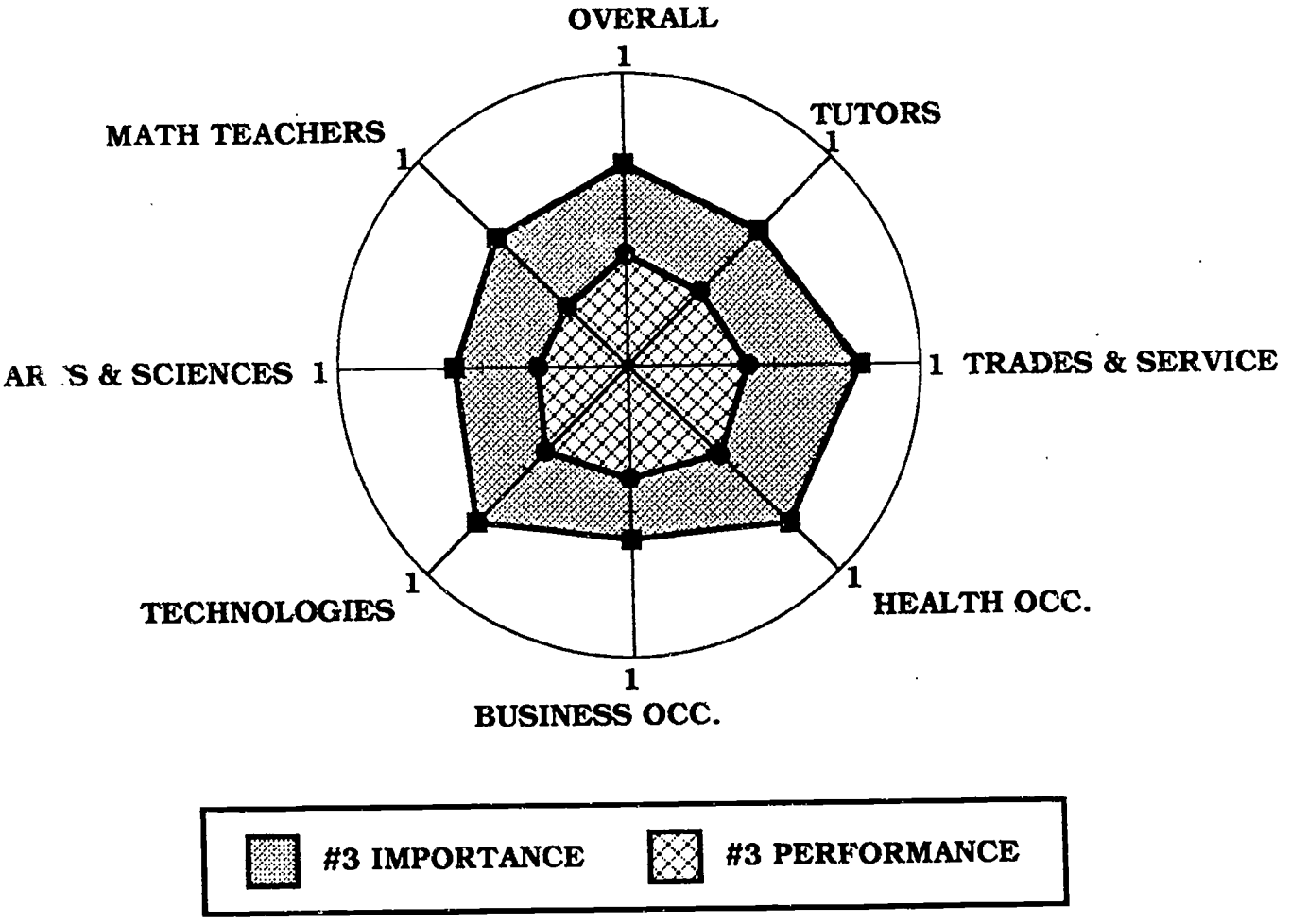
This skill is most important to: TRADES & SERVICE OCCUPATIONS
This skill is least important to: ARTS & SCIENCES
Greatest difference between "importance" and "performance:" TECHNOLOGIES

Note: Most groups at T-VI view this skill as unimportant. The SCANS Report and the National Council of Teachers of Mathematics view it as very important. This graph represents an incongruity which probably needs further study.

SKILL #3: Ability to apply a variety of strategies to solution of a problem



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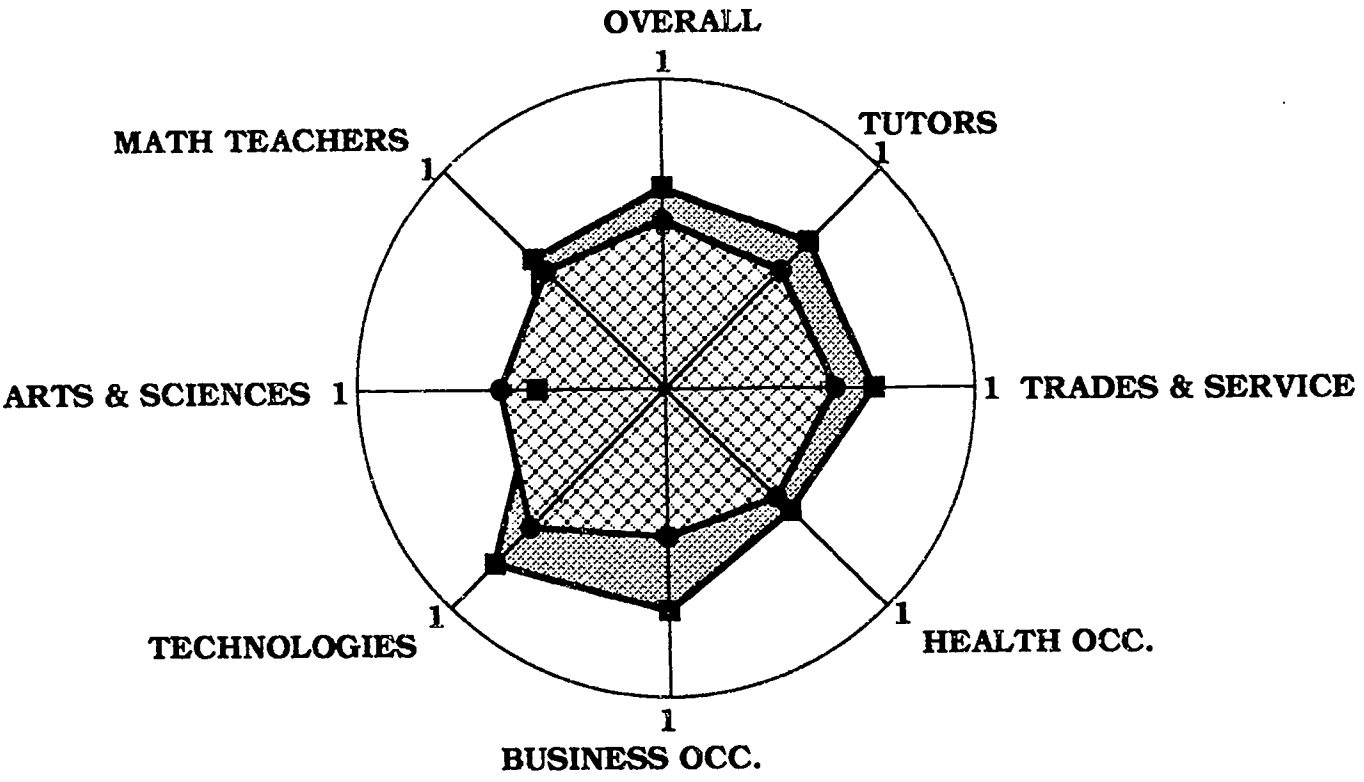
This skill is most important to: TRADES & SERVICE OCCUPATIONS
This skill is least important to: BUSINESS OCCUPATIONS
Greatest difference between "importance" and "performance:" TRADES & SERVICE OCCUPATIONS

Note: This skill is generally perceived as being important and poorly performed.

SKILL #4: Ability to use an electronic calculator as a problem-solving tool



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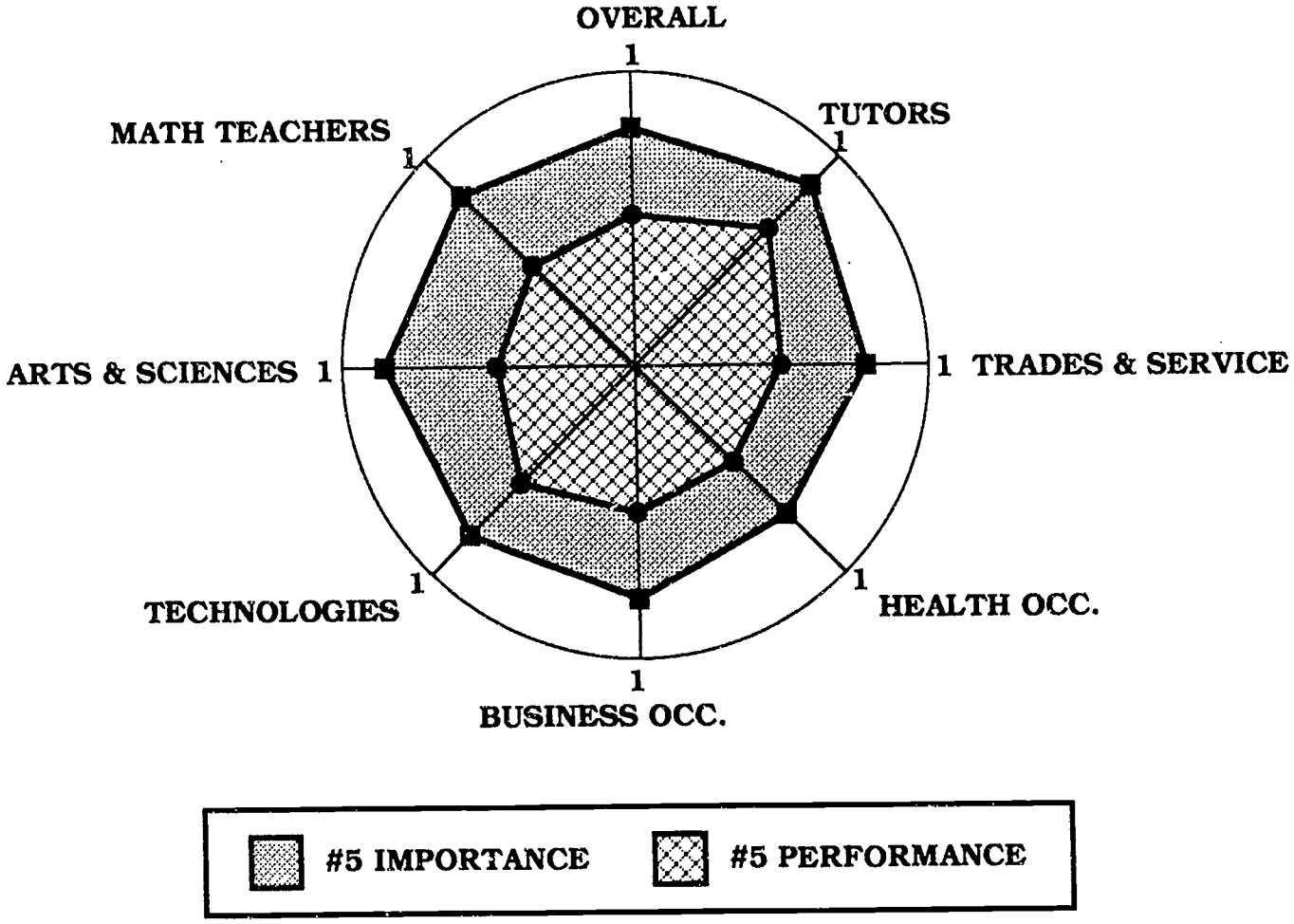
This skill is most important to: TECHNOLOGIES
This skill is least important to: ARTS & SCIENCES
Greatest difference between "importance" and "performance:" BUSINESS OCCUPATIONS

Note: Several groups see this skill as unimportant. This graph may represent a situation which warrants further study, since industrial standards like the SCANS Report and academic standards like those from NCTM place high value on this skill.

SKILL #5: Ability to apply arithmetic skills to common real-life problems



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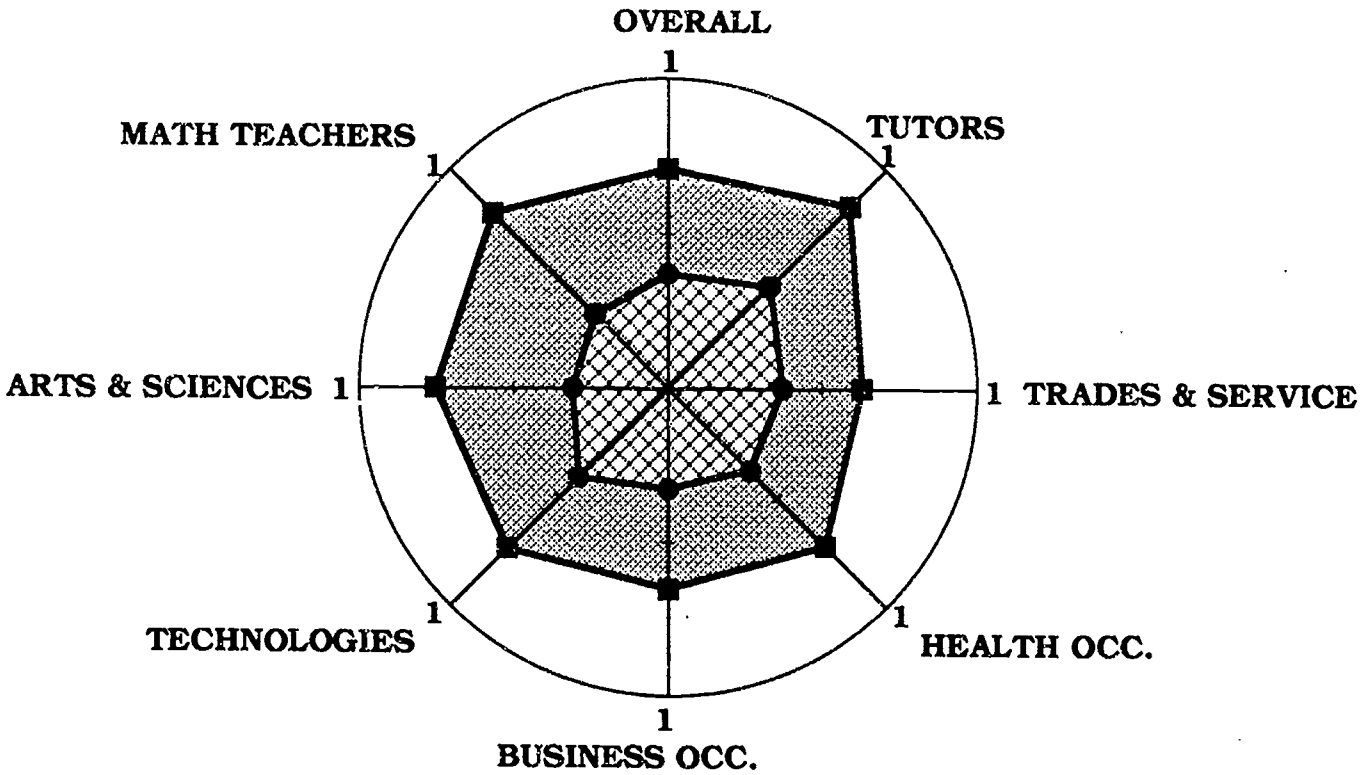
3. The larger the gap between the two points on an axis, the greater the disparity between "importance" and "performance."

This skill is most important to: ARTS & SCIENCES; TUTORS
This skill is least important to: HEALTH OCCUPATIONS
Greatest difference between "importance" and "performance:" ARTS & SCIENCES

Note: There is a large disparity between the perceived importance of this skill and its performance in Arts & Sciences and among math teachers. Further study of ways to correct this disparity may be warranted.

SKILL #6: Ability to translate problem situations into mathematical expressions (i.e., communicate in the language of math)



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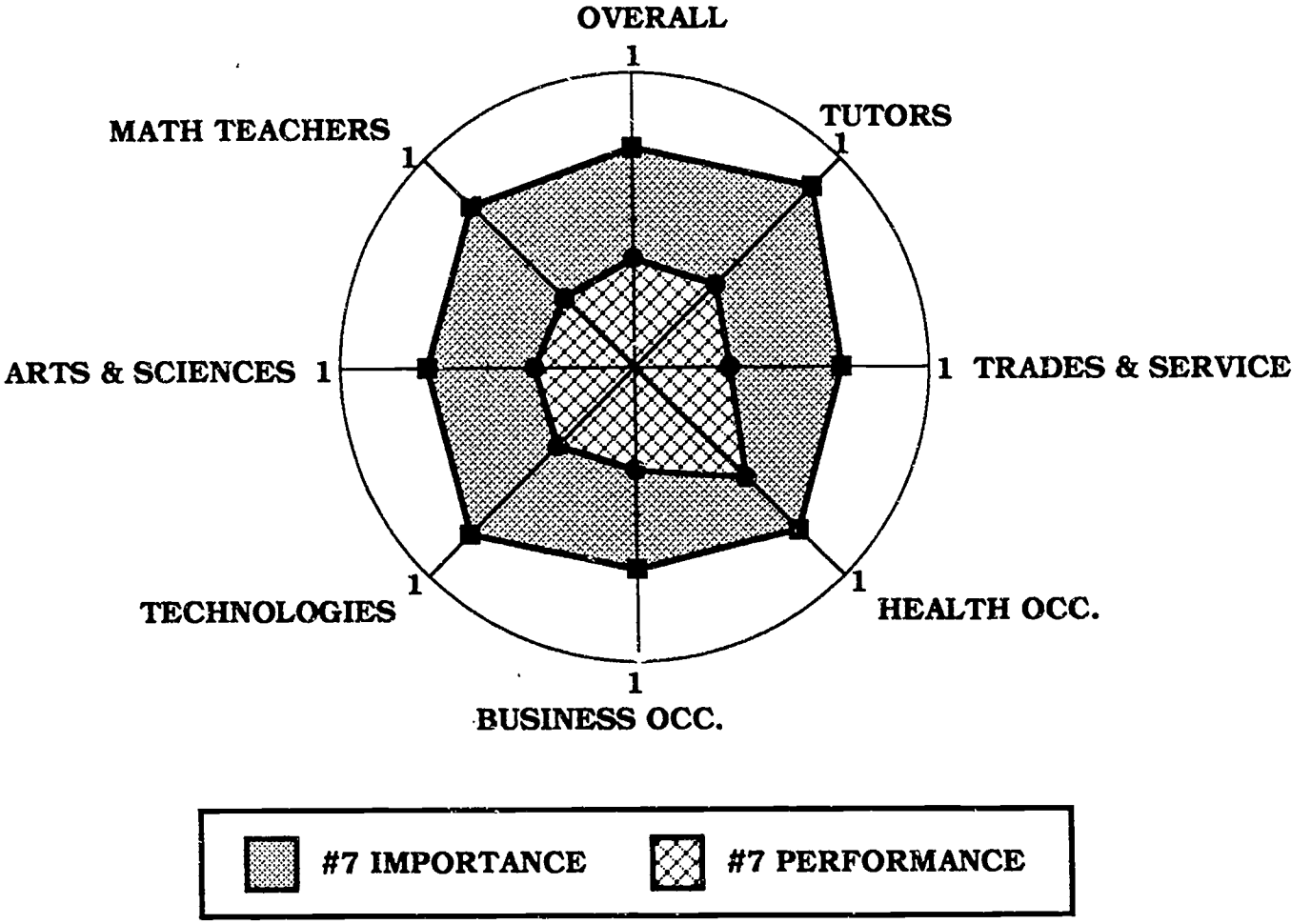
3. The larger the gap between the two points on an axis, the greater the disparity between "importance" and "performance."

This skill is most important to: TUTORS; MATH TEACHERS
This skill is least important to: BUSINESS OCCUPATIONS; TRADES AND SERVICE OCCUPATIONS
Greatest difference between "importance" and "performance:" ARTS & SCIENCES; MATH TEACHERS

SKILL #7: Possessing confidence in one's ability to use math to solve problems



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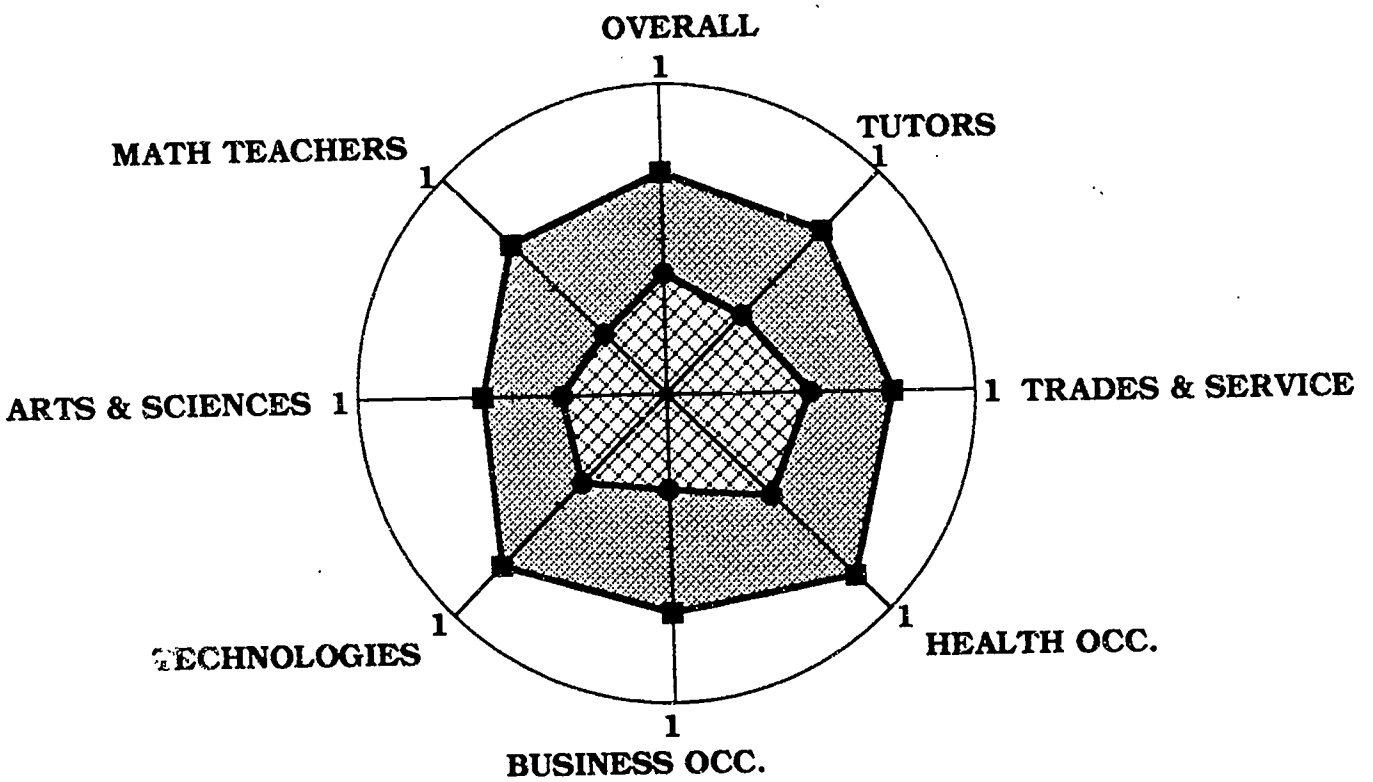
3. The larger the gap between the two points on an axis, the greater the disparity between "importance" and "performance."

This skill is most important to: TUTORS
This skill is least important to: BUSINESS OCCUPATIONS
Greatest difference between "importance" and "performance:" TUTORS

SKILL #8: Ability to estimate or approximate likely solutions to simple problems with reasonable accuracy



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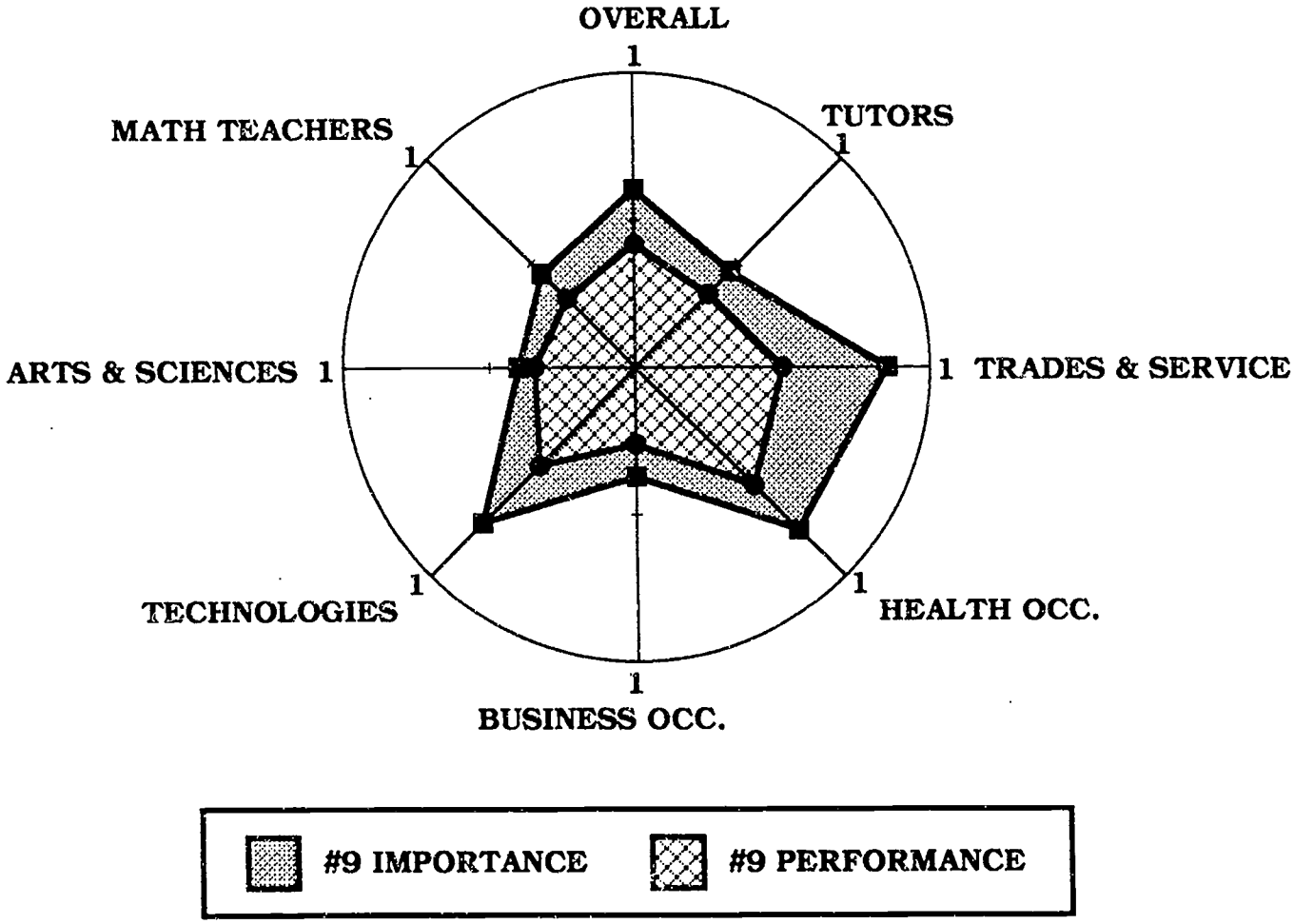
3. The larger the gap between the two points on an axis, the greater the disparity between "importance" and "performance."

This skill is most important to: HEALTH OCCUPATIONS
This skill is least important to: ARTS & SCIENCES
Greatest difference between "importance" and "performance:" MATH TEACHERS; BUSINESS OCCUPATIONS

SKILL #9: Ability to use common measuring tools, scales and instruments



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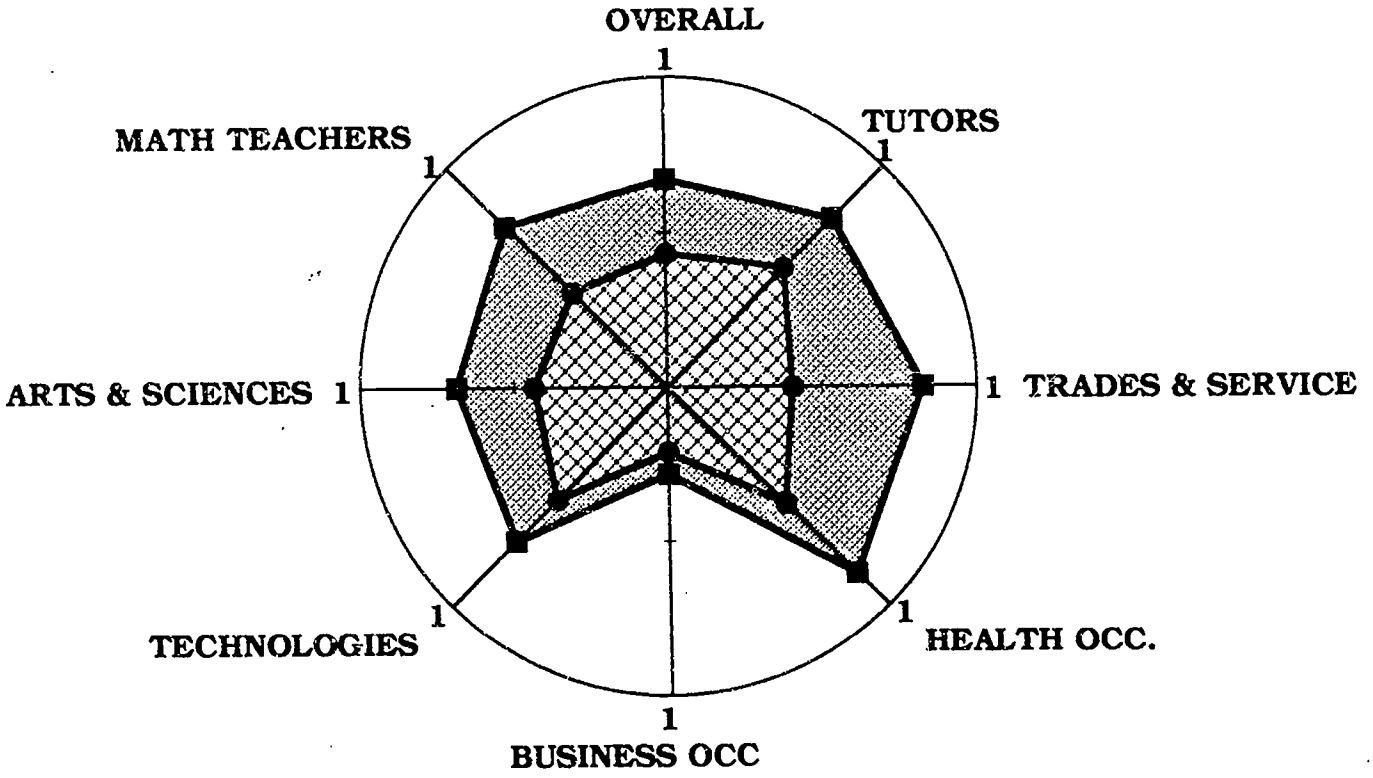
This skill is most important to: TRADES & SERVICE OCCUPATONS
This skill is least important to: BUSINESS OCCUPATIONS
Greatest difference between "importance" and "performance:" TRADES & SERVICE OCCUPATIONS

Note: A good example of how different math skills are valued differently by different groups.

SKILL #10: Understanding of length, weight, area, volume, time, temperature and angle



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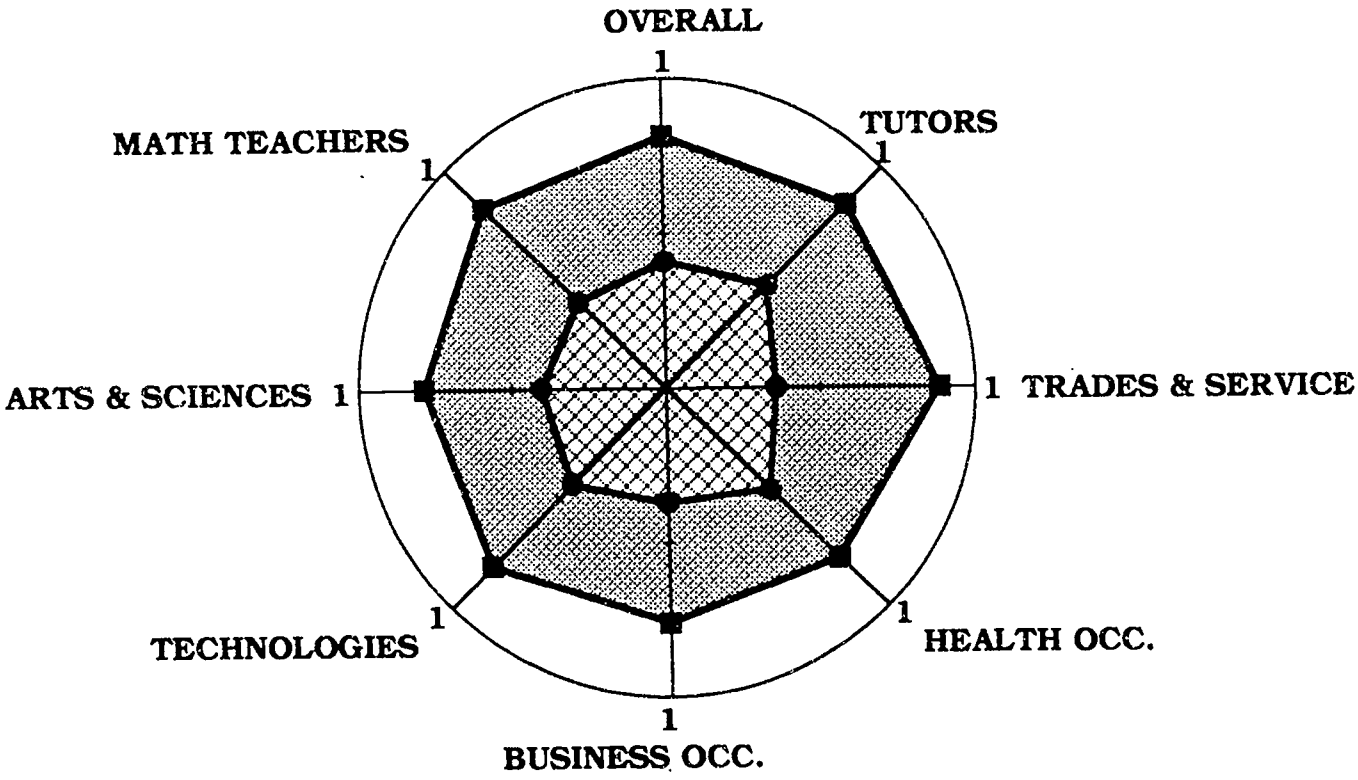
This skill is most important to: HEALTH OCCUPATIONS; TRADES & SERVICE OCCUPATIONS
This skill is least important to: BUSINESS OCCUPATIONS
Greatest difference between "importance" and "performance:" TRADES & SERVICE OCCUPATIONS

SKILL #11: Demonstrating "number sense" for fractions, decimals and percents: equivalents, relative sizes, relationships, sequences, etc.



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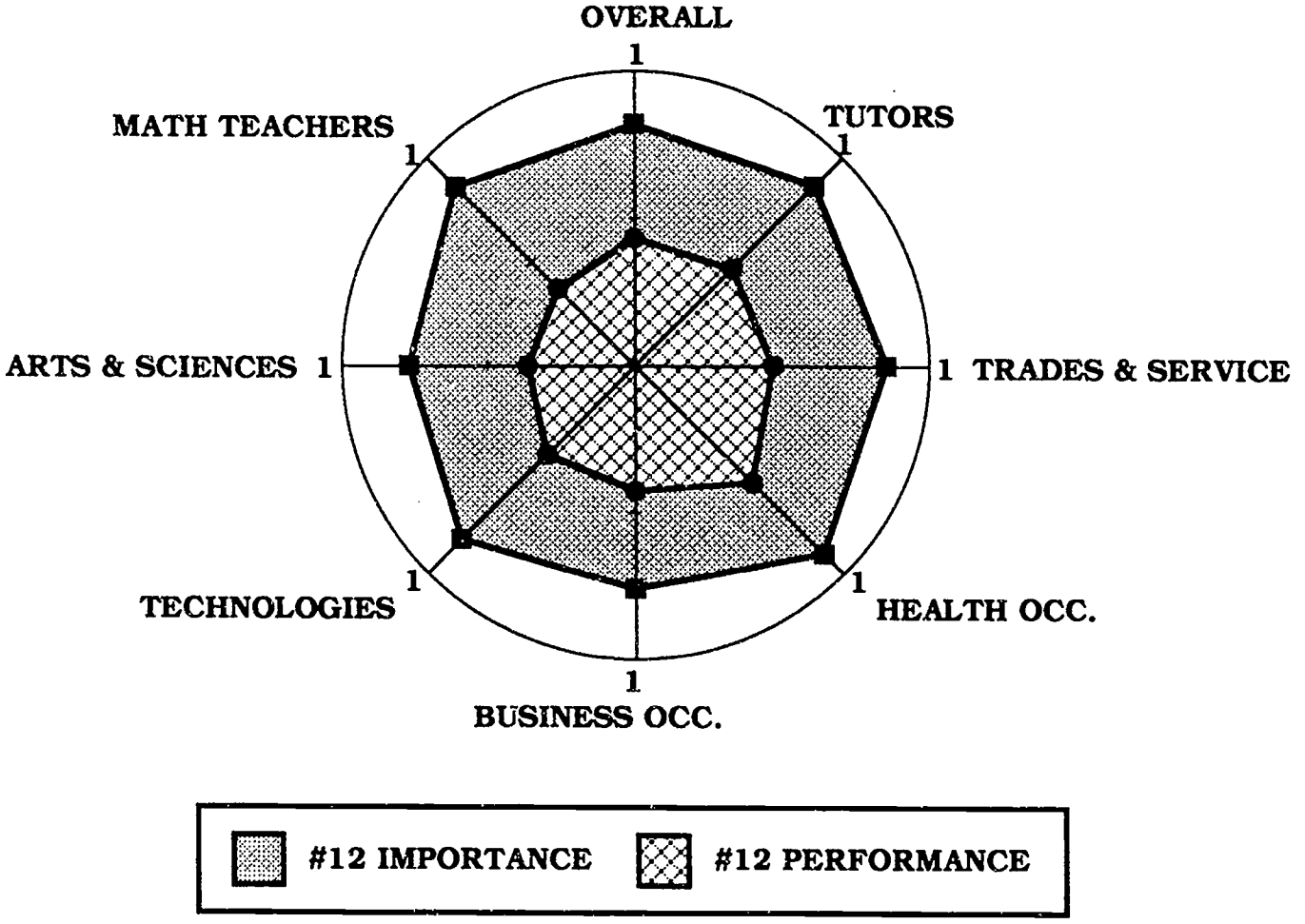
This skill is most important to: TRADES & SERVICE OCCUPATIONS
This skill is least important to: BUSINESS OCCUPATIONS
Greatest difference between "importance" and "performance:" TRADES & SERVICE OCCUPATIONS

Note: All groups think this skill is important; none thinks it's performed well. There is a large importance/performance gap in Trades.

SKILL #12: Using the skills of reading, listening and viewing to interpret and evaluate mathematical problems



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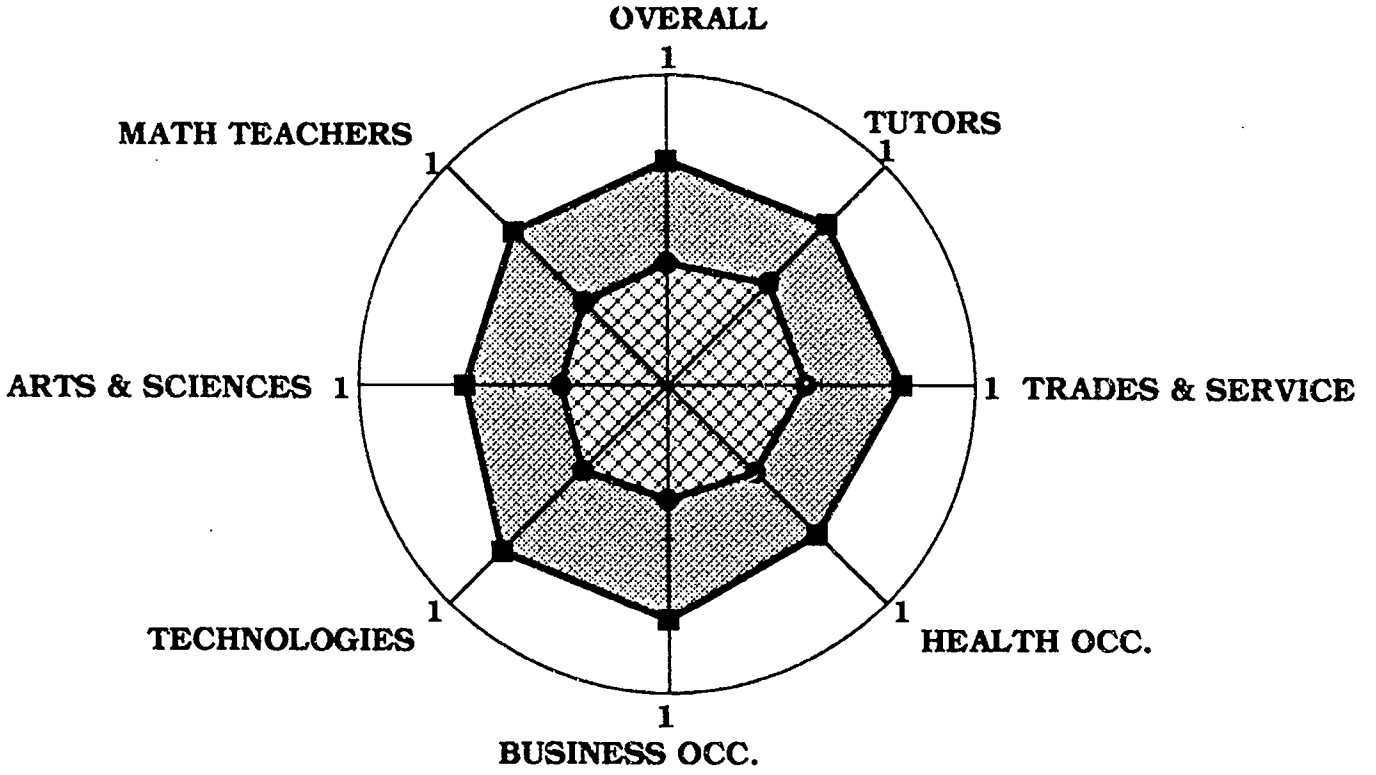
This skill is most important to: HEALTH OCCUPATIONS
This skill is least important to: BUSINESS OCCUPATIONS
Greatest difference between "importance" and "performance:" MATH TEACHERS

Note: This graph represents a situation that may warrant further study. The skill is seen as being quite important and poorly performed. However, the skill is not formally part of the mathematics curriculum at T-VI.

SKILL #13: Understanding and applying ratios, proportions, and percents in a wide variety of real-life situations



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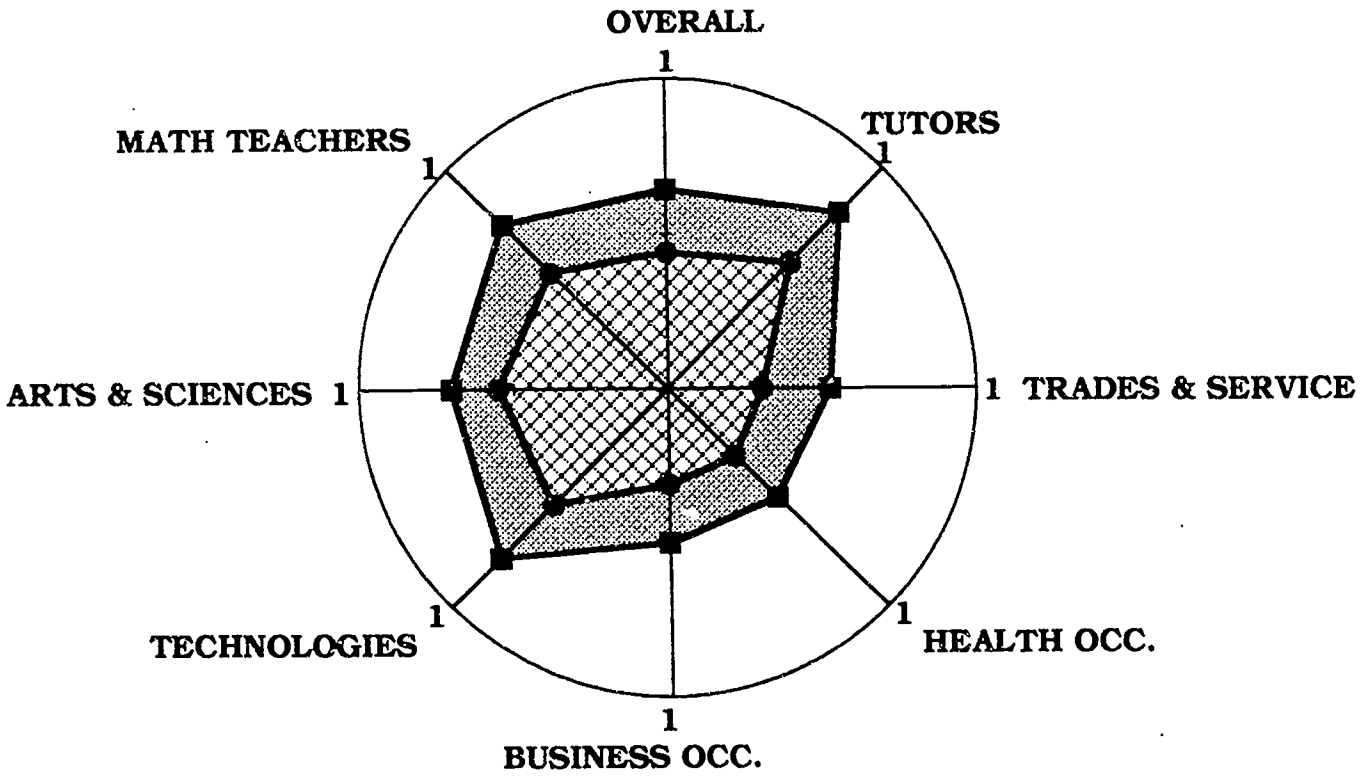
This skill is most important to: TRADES & SERVICE OCCUPATIONS; TECHNOLOGIES; BUSINESS OCCUPATIONS
This skill is least important to: ARTS & SCIENCES
Greatest difference between "importance" and "performance:" BUSINESS OCCUPATIONS; TECHNOLOGIES

SKILL #14: Demonstrating "number sense" with positive and negative numbers



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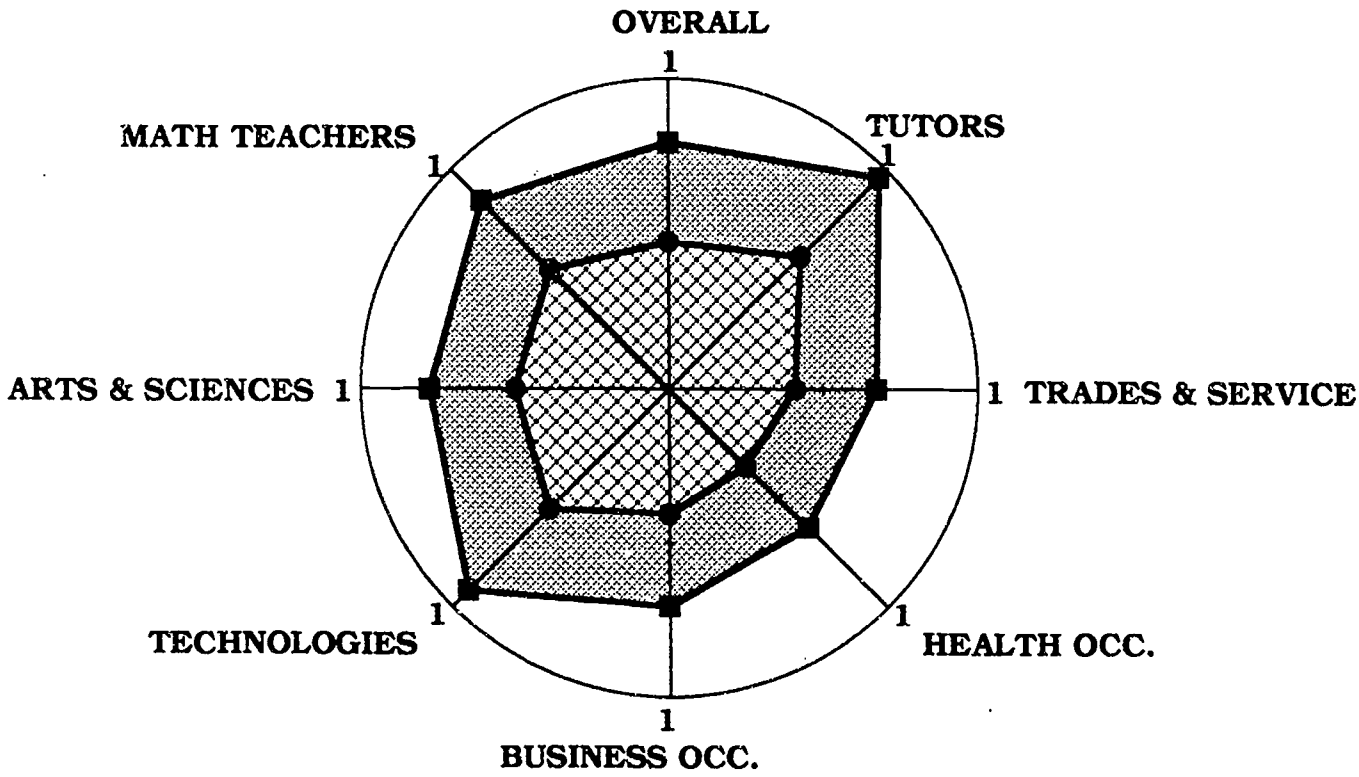
3. The larger the gap between the two points on an axis, the greater the disparity between "importance" and "performance."

This skill is most important to: TUTORS; TECHNOLOGIES
This skill is least important to: BUSINESS OCCUPATIONS; HEALTH OCCUPATIONS
Greatest difference between "importance" and "performance:" NA

Note: Another good example of the fact that different groups define "basic math skills" differently.

SKILL #15: Understanding the order of operations and the relationships among the basic operations



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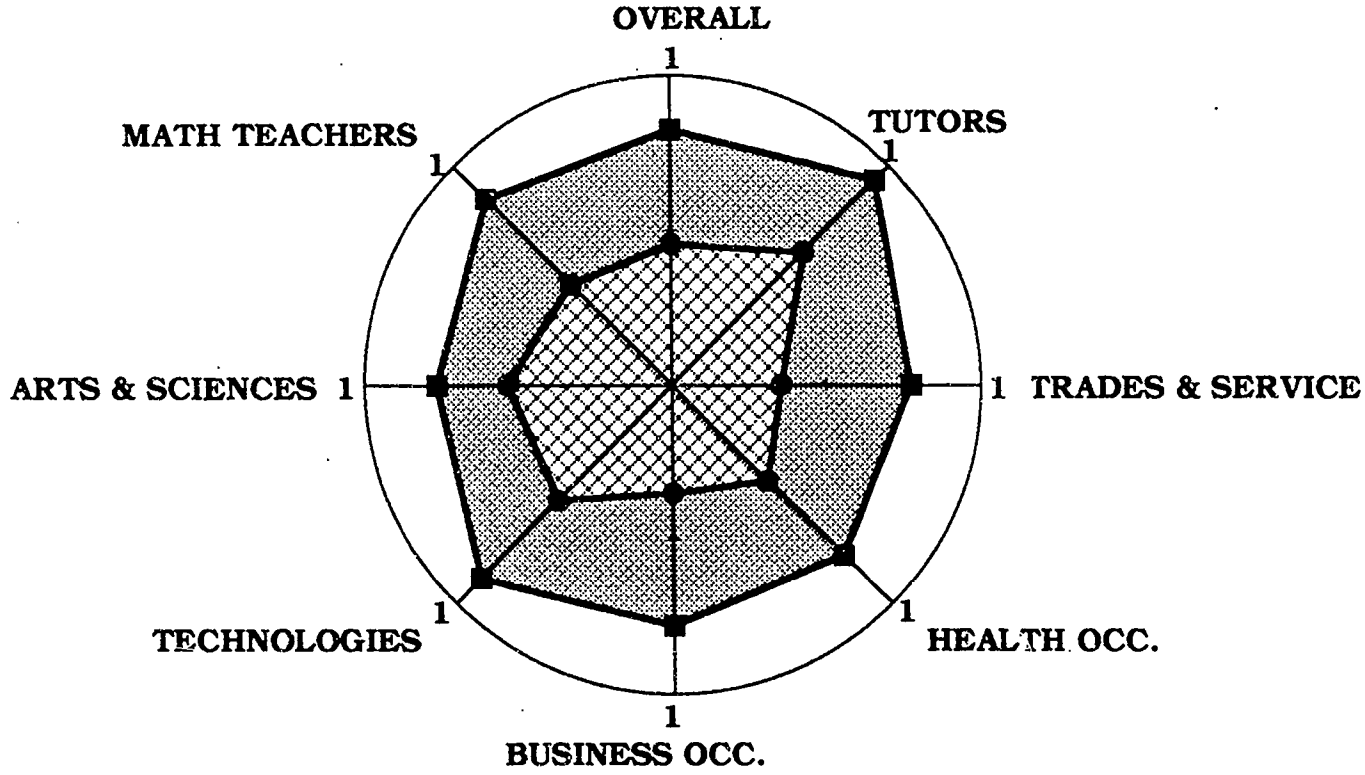
3. The larger the gap between the two points on an axis, the greater the disparity between "importance" and "performance."

This skill is most important to: TUTORS; TECHNOLOGIES
This skill is least important to: HEALTH OCCUPATIONS
Greatest difference between "importance" and "performance:" TECHNOLOGIES

Note: A large gap exists overall between importance and performance. This skill is very important to Technologies and to the tutors.

SKILL #16: Computing with whole numbers, fractions, decimals, integers and rational numbers



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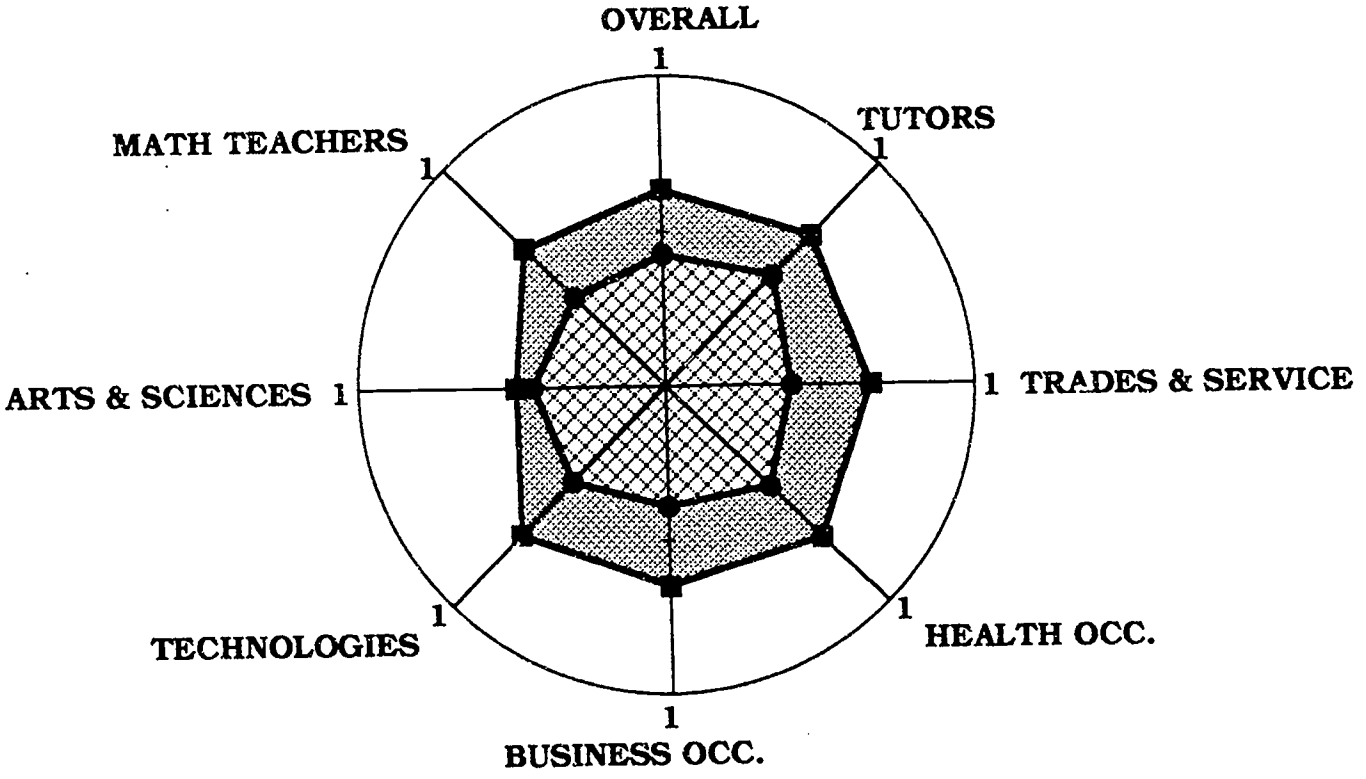
This skill is most important to: TUTORS
This skill is least important to: Important to all groups.
Greatest difference between "importance" and "performance:" BUSINESS OCCUPATIONS

SKILL #17: Ability to select appropriate methods of computing from among mental arithmetic, paper-and-pencil, calculator and/or computer



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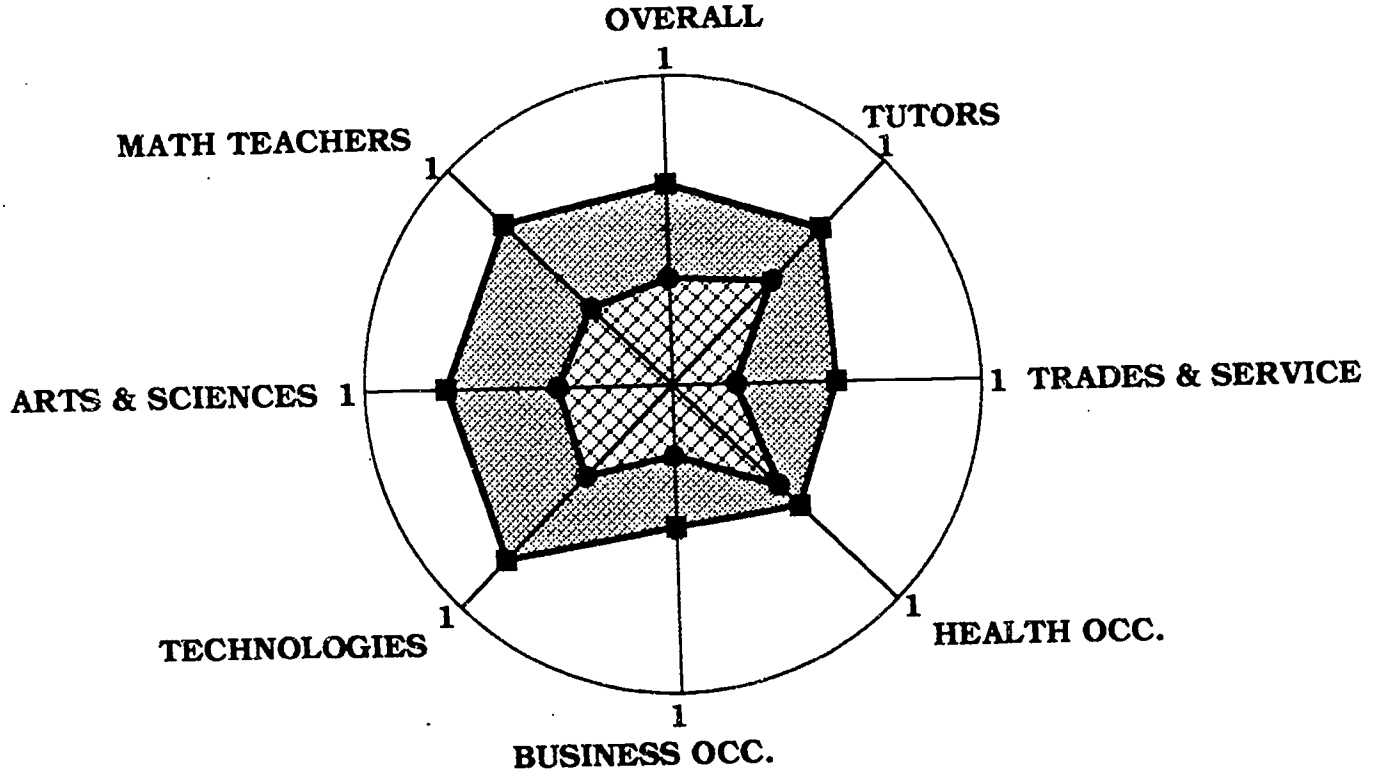
This skill is most important to: See note below.
This skill is least important to: ARTS & SCIENCES
Greatest difference between "importance" and "performance:" NA

Note: This skill is not seen as very important by any group. This graph depicts a situation that may warrant further study, since academic standards (NCTM) and industrial recommendations (SCANS Report) indicate its importance.

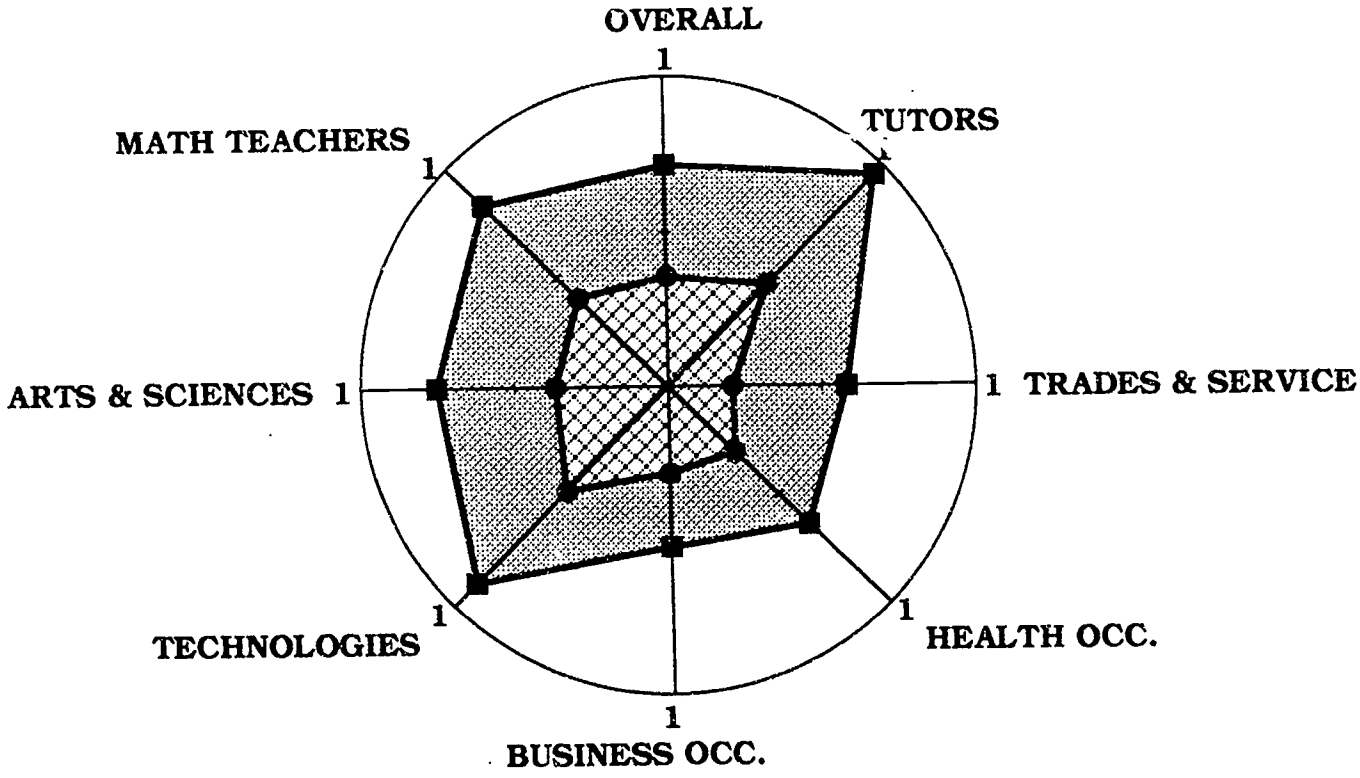
SKILL #18: Understanding the concepts of variable, expression and equation



1. The closer the dark pattern is to "1," the more important the skill.
2. The closer the light pattern is to "1," the better the skill is performed.
3. The larger the gap between the two points on an axis, the greater the disparity between "importance" and "performance."

This skill is most important to: TECHNOLOGIES, MATH TEACHERS, ARTS & SCIENCES
This skill is least important to: BUSINESS OCCUPTATIONS
Greatest difference between "importance" and "performance:" TECHNOLOGIES, MATH TEACHERS, ARTS & SCIENCES

SKILL #19: Ability to use algebraic concepts to manipulate and apply basic formulas



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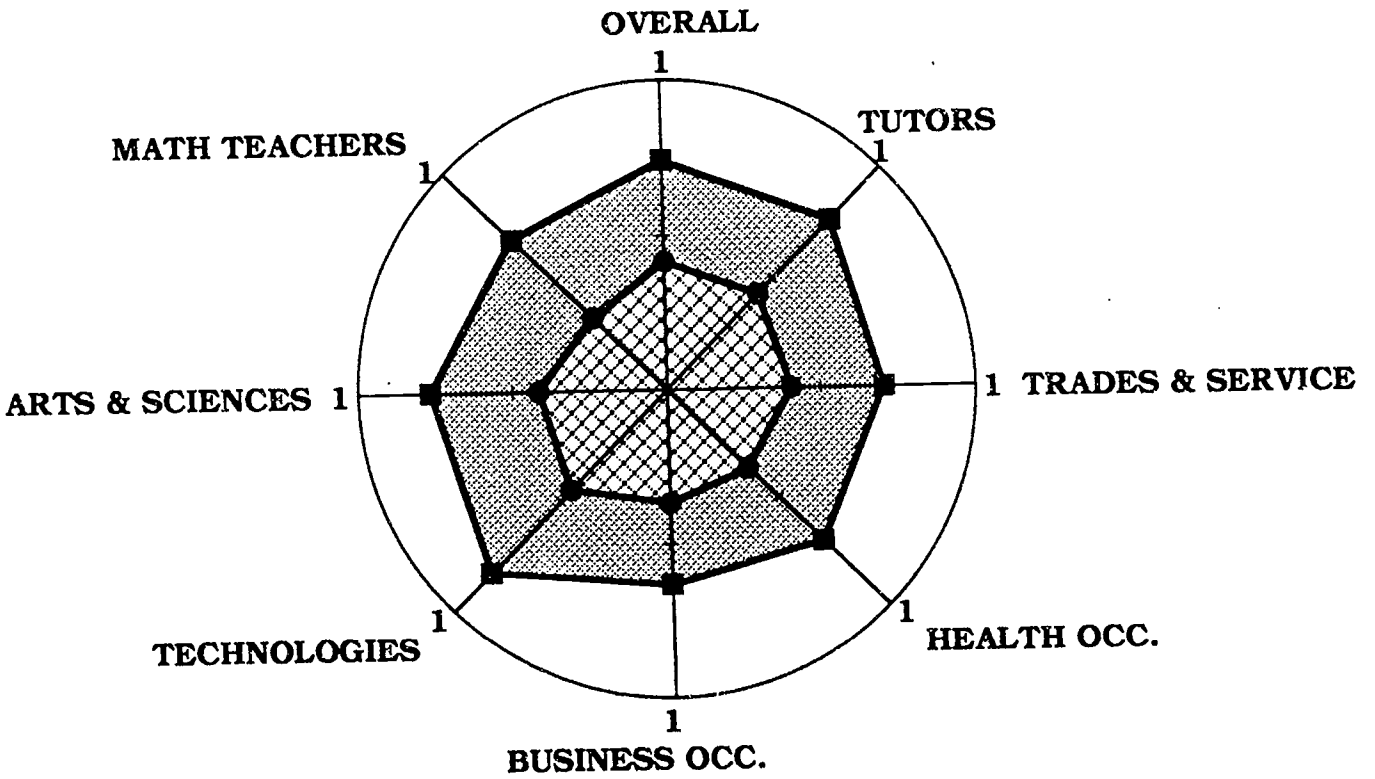
2. The closer the light pattern is to "1," the better the skill is performed.
3. The larger the gap between the two points on an axis, the greater the disparity between "importance" and "performance."

This skill is most important to: TUTORS; TECHNOLOGIES; MATH TEACHERS
This skill is least important to: BUSINESS OCCUPATIONS; TRADES & SERVICE OCCUPATIONS; HEALTH OCCUPATIONS
Greatest difference between "importance" and "performance:" TUTORS; MATH TEACHERS

SKILL #20: Constructing, reading and interpreting tables, charts and graphs



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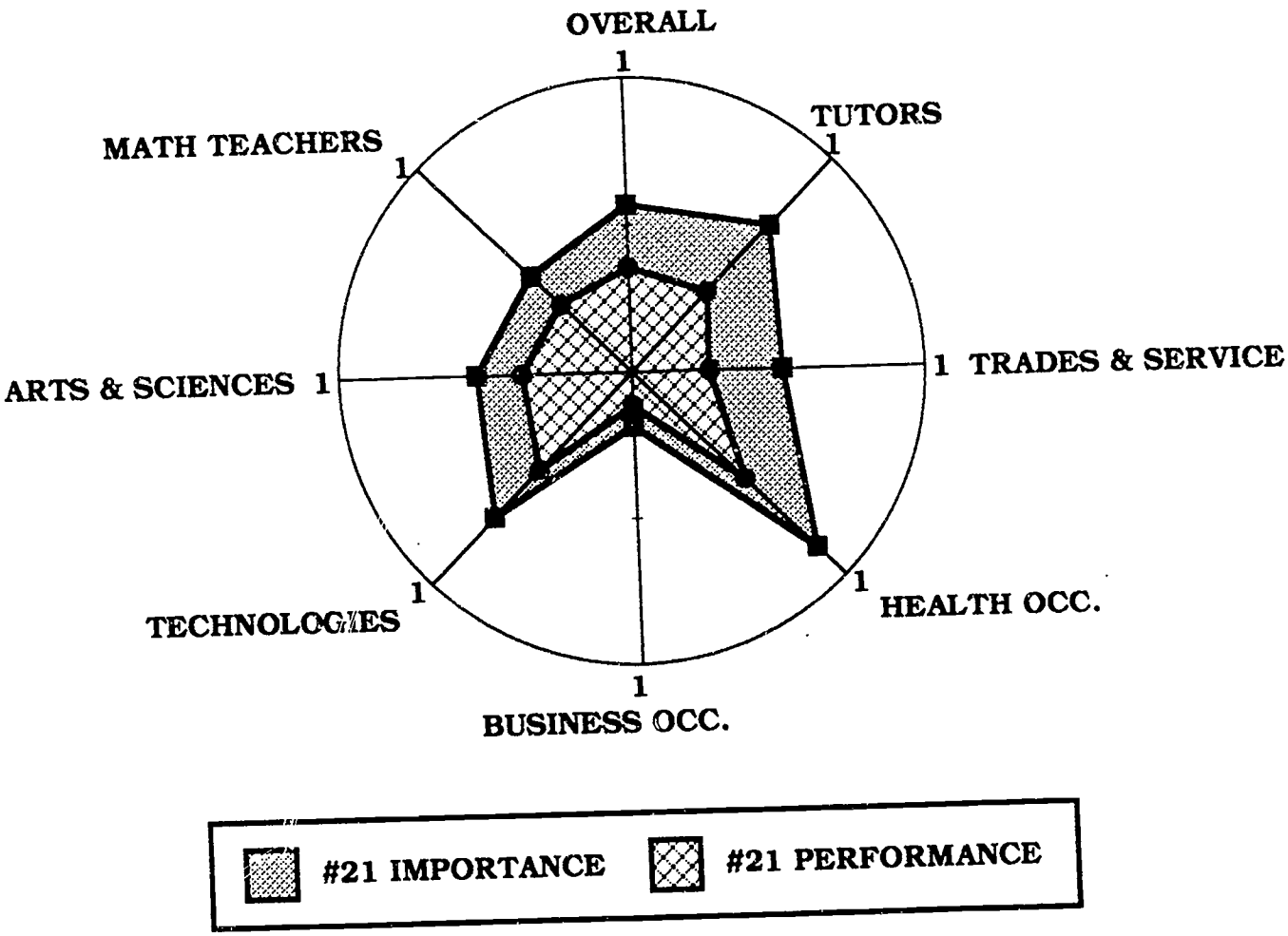
3. The larger the gap between the two points on an axis, the greater the disparity between "importance" and "performance."

This skill is most important to: TECHNOLOGIES
This skill is least important to: BUSINESS OCCUPATIONS
Greatest difference between "importance" and "performance:" MATH TEACHERS

SKILL #21: Understanding the structure and use of the metric and traditional systems of measurement



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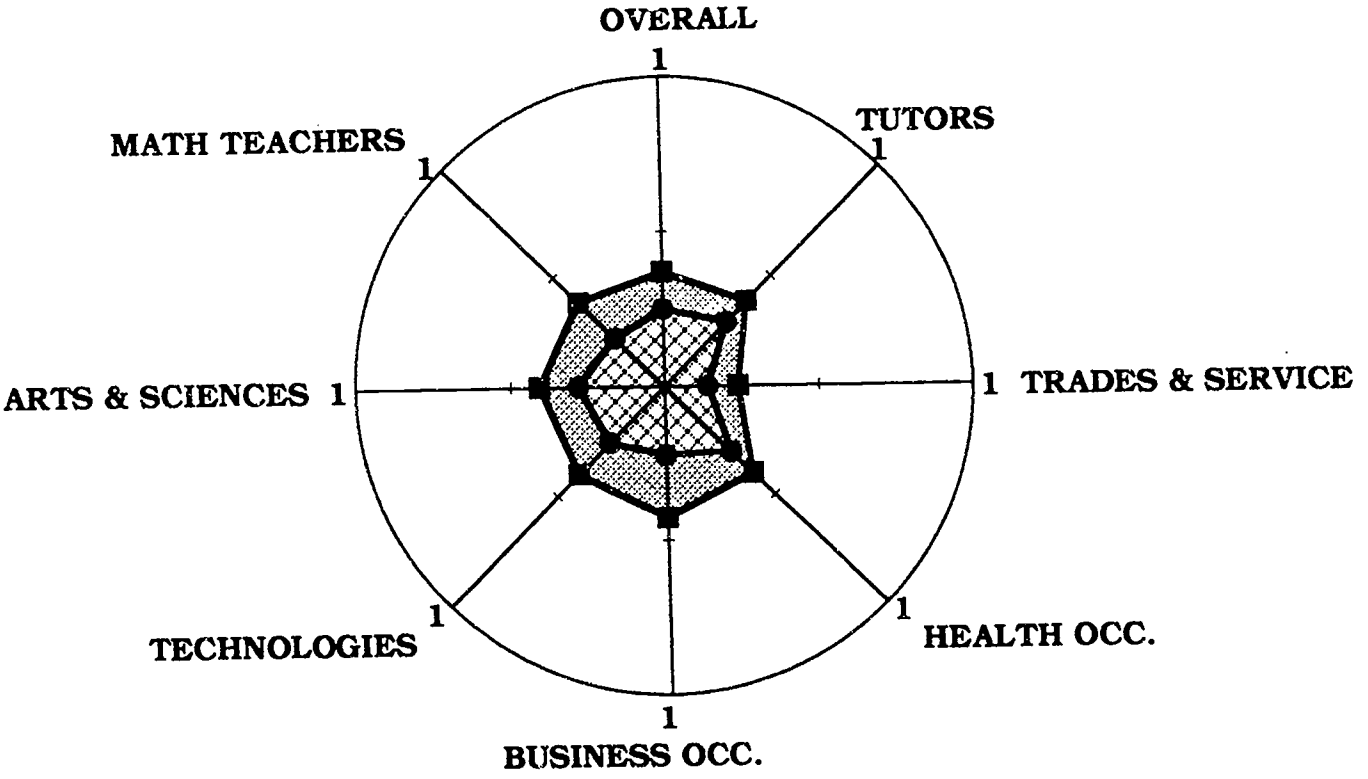
This skill is most important to: HEALTH OCCUPATIONS
This skill is least important to: BUSINESS OCCUPATIONS
Greatest difference between "importance" and "performance:" TUTORS; HEALTH OCCUPATIONS

Note: The math teachers do not see this skill as important.

SKILL #22: Ability to apply measures of central tendency (mean, median, mode) to real-life situations



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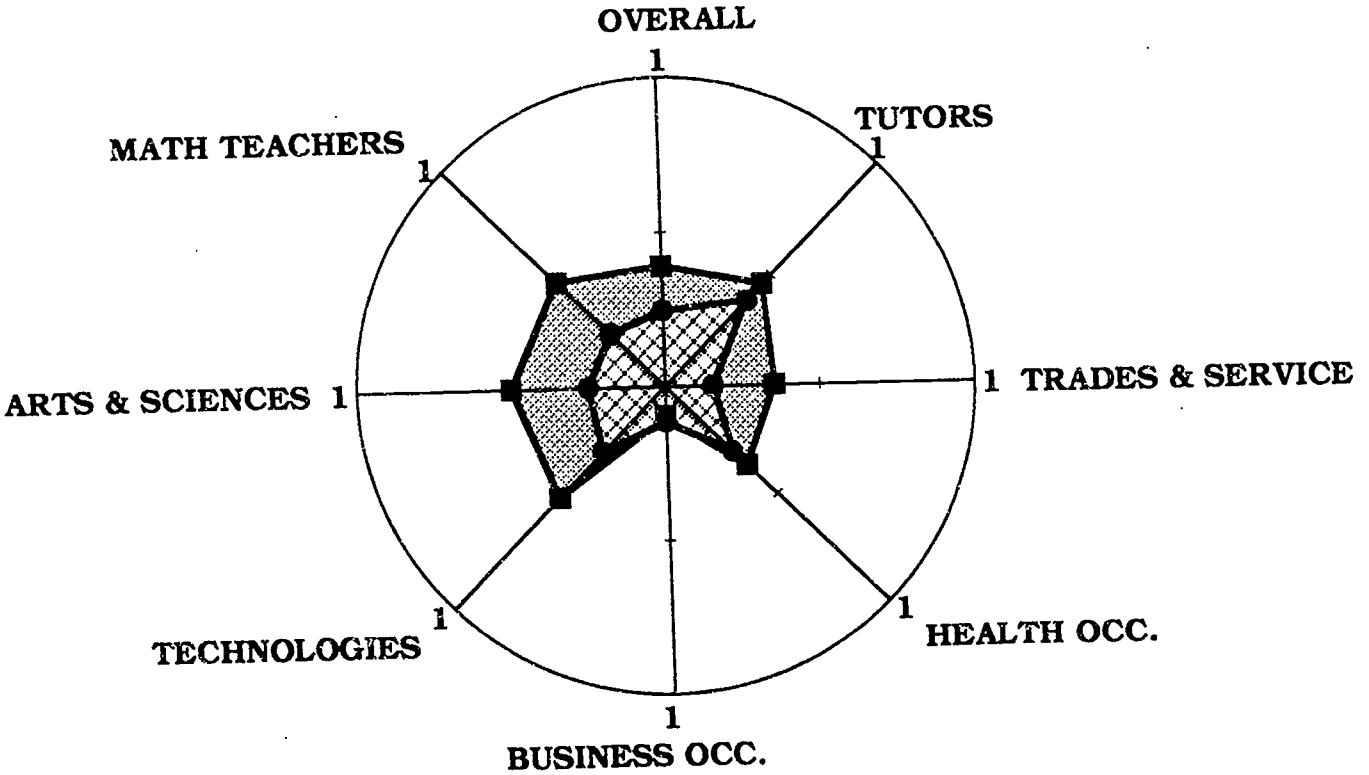
3. The larger the gap between the two points on an axis, the greater the disparity between "importance" and "performance."

This skill is most important to: NA
This skill is least important to: NA
Greatest difference between "importance" and "performance:" NA

Note: All groups indicate that this skill is unimportant. The SCANS Report and NCTM both state that this and other statistical skills are important. This graph represents an incongruity that warrants further study.

SKILL #23: Ability to represent and solve problems using geometric models



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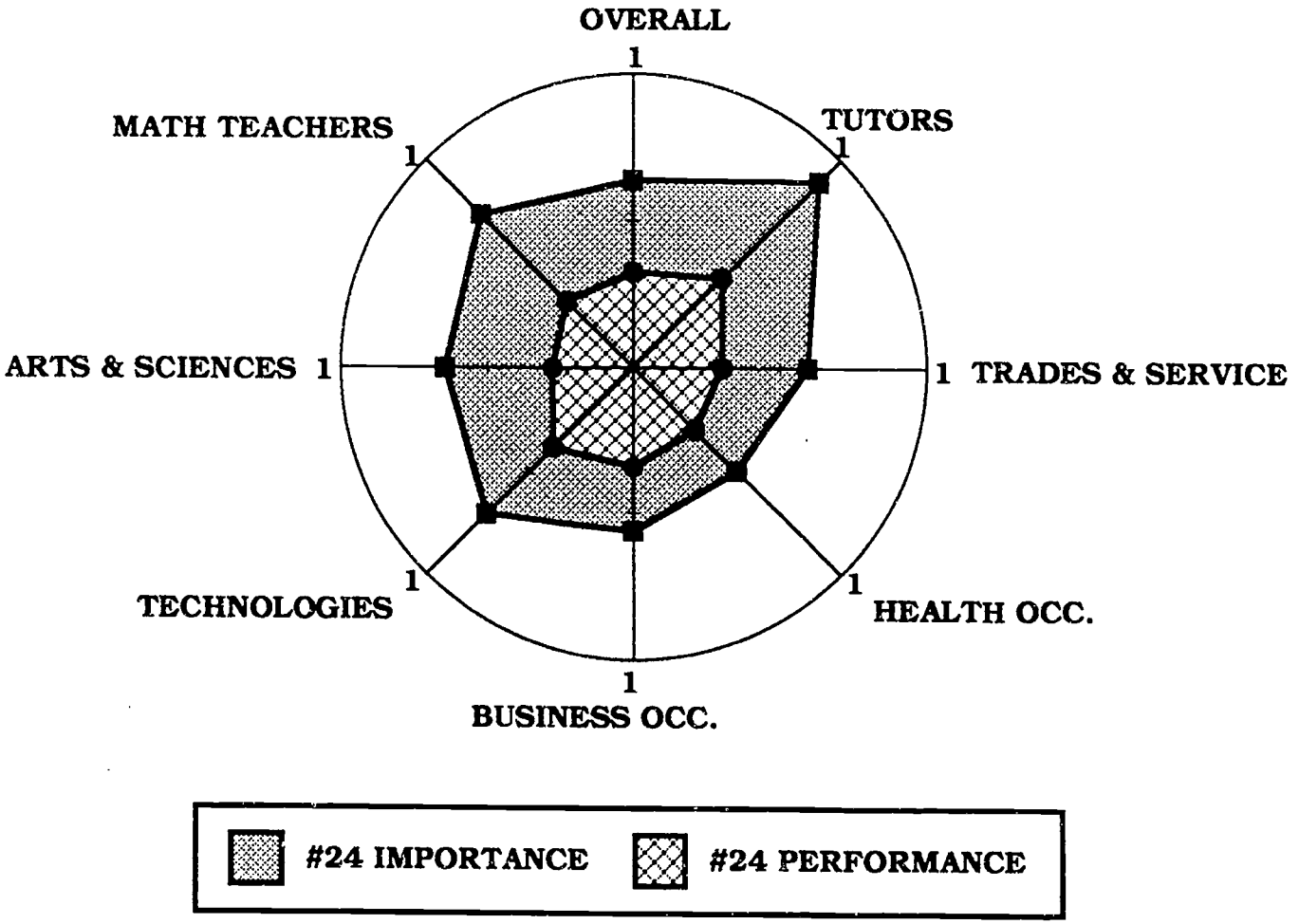
This skill is most important to: ARTS & SCIENCES
This skill is least important to: BUSINESS OCCUPATIONS
Greatest difference between "importance" and "performance:" ARTS & SCIENCES

Note: This skill is not very important to any group.

SKILL #24: Expressing mathematical ideas orally and in writing



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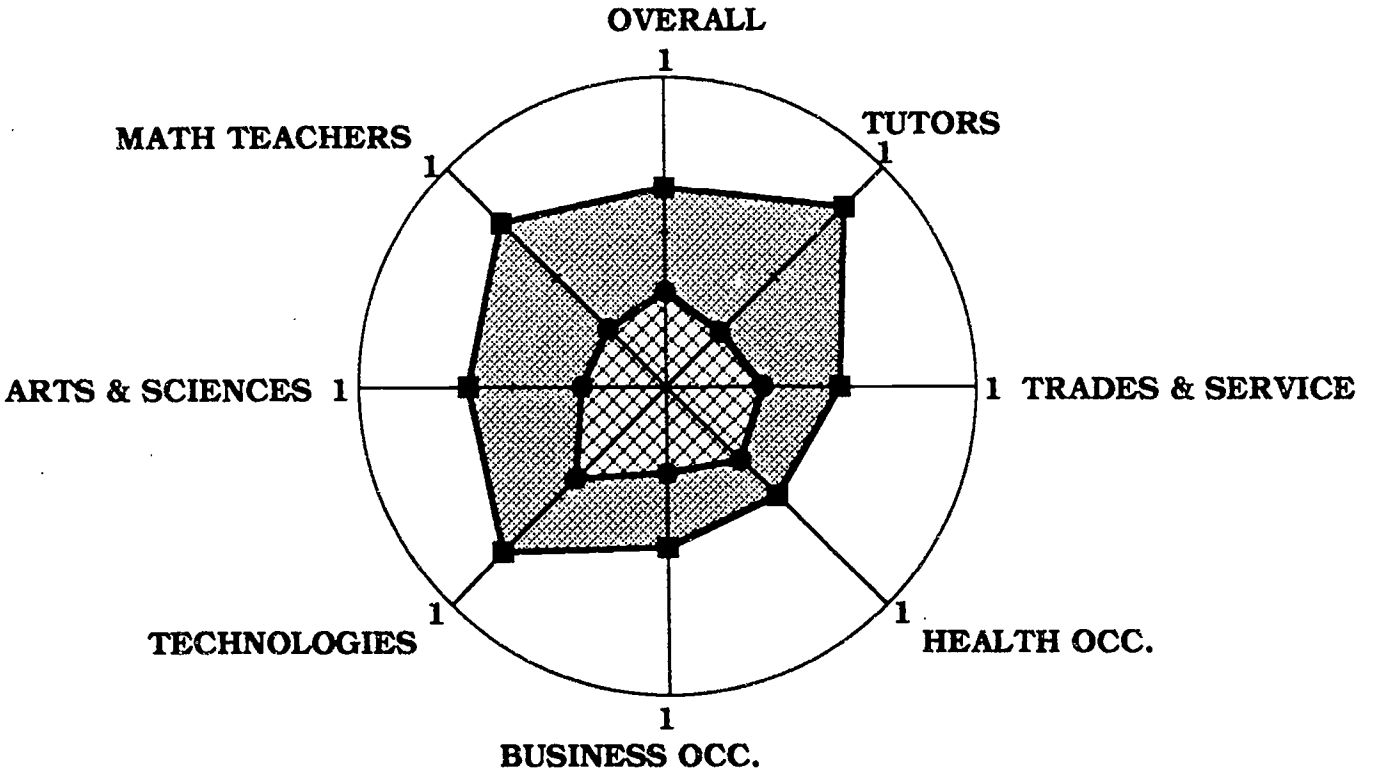
This skill is most important to: TUTORS
This skill is least important to: HEALTH OCCUPATIONS
Greatest difference between "importance" and "performance:" TUTORS

SKILL #25: Understanding the connections between and applications of mathematics to other academic disciplines and vocational fields



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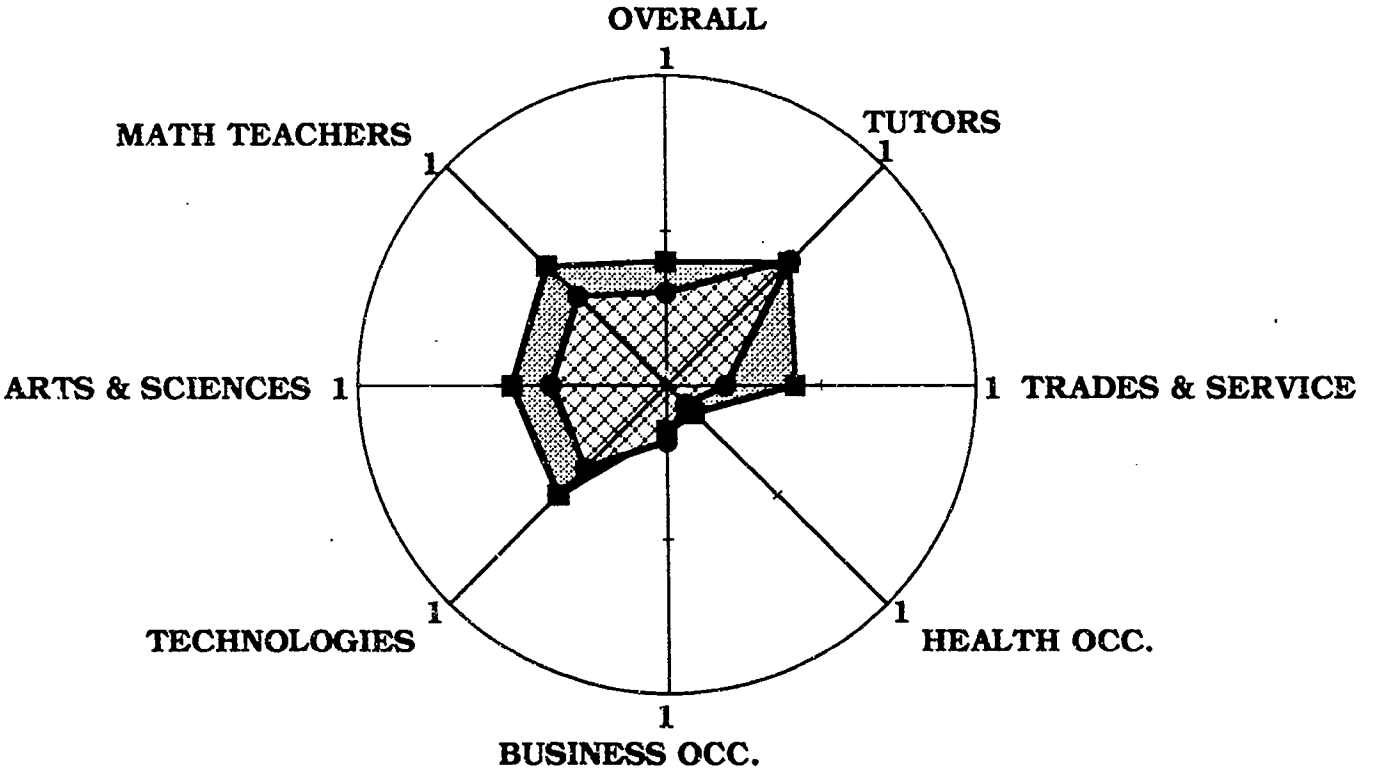
3. The larger the gap between the two points on an axis, the greater the disparity between "importance" and "performance."

This skill is most important to: TUTORS; MATH TEACHERS; TECHNOLOGIES
This skill is least important to: BUSINESS OCCUPATIONS; HEALTH OCCUPATIONS
Greatest difference between "importance" and "performance:" TUTORS; MATH TEACHERS

Note: All groups see this skill as being performed very poorly. According to NCTM, this is one of the most important outcomes of basic math instruction.

SKILL #26: Identifying, classifying, describing and comparing geometric figures



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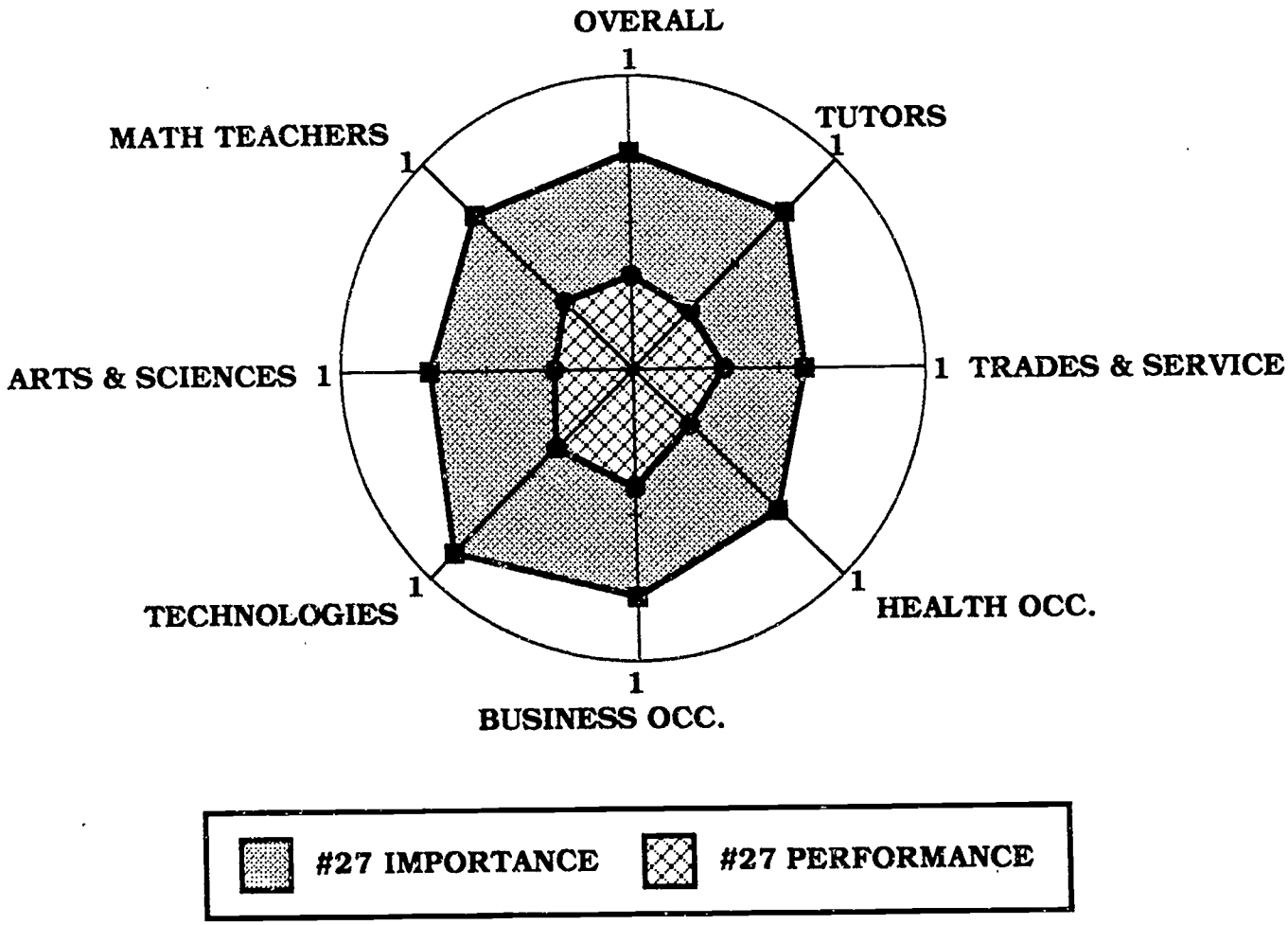
This skill is most important to: NA
This skill is least important to: HEALTH OCCUPATIONS
Greatest difference between "importance" and "performance:" NA

Note: This skill is generally perceived as unimportant by all groups.

SKILL #27: Ability to systematically collect, organize and describe data



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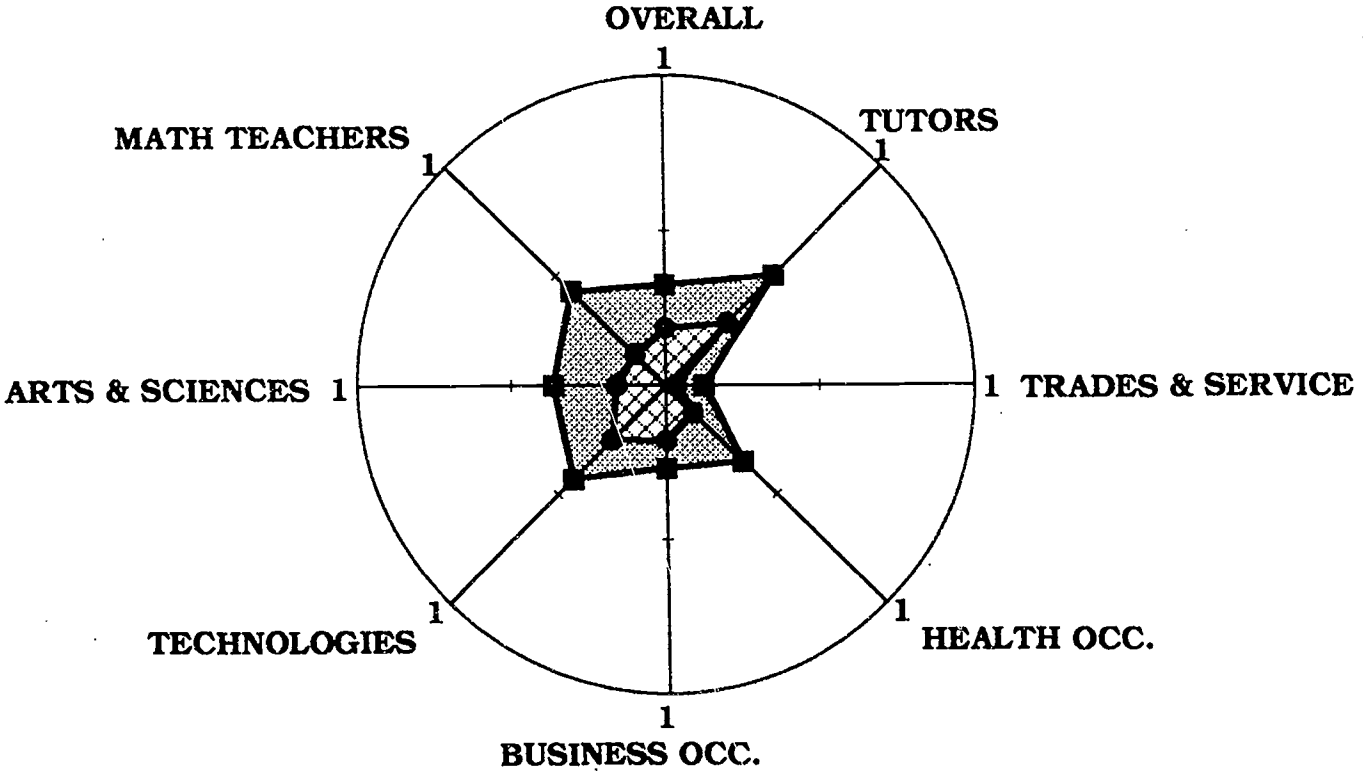
3. The larger the gap between the two points on an axis, the greater the disparity between "importance" and "performance."

This skill is most important to: TECHNOLOGIES
This skill is least important to: TRADES & SERVICE OCCUPATIONS
Greatest difference between "importance" and "performance:" TECHNOLOGIES

Note: This skill is generally seen as important. It may warrant further study, since it may not be a skill that is formally addressed in math curricula at T-VI.

SKILL #28: Using the properties of the normal curve to answer questions about data that are assumed to be normally distributed



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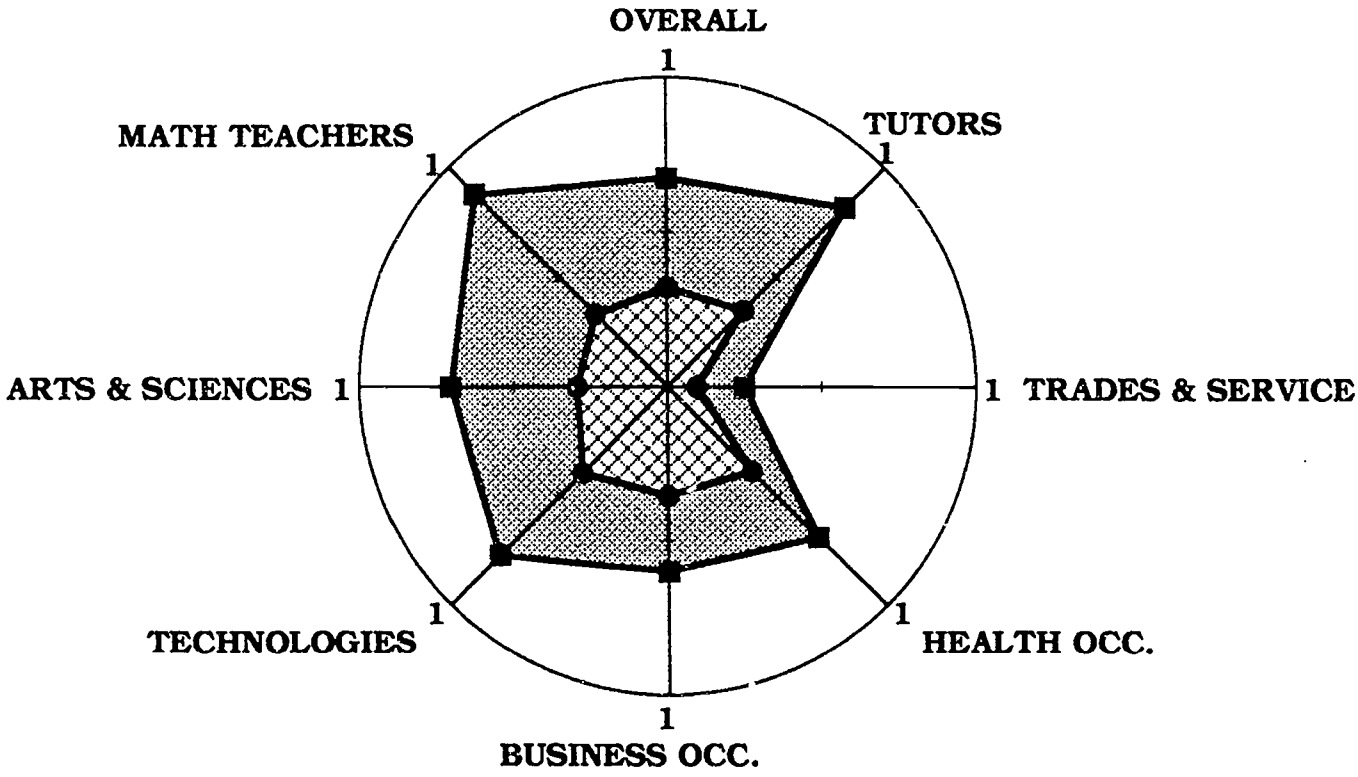
3. The larger the gap between the two points on an axis, the greater the disparity between "importance" and "performance."

This skill is most important to: TUTORS (see note below)
This skill is least important to: TRADES & SERVICE OCCUPATIONS
Greatest difference between "importance" and "performance:" MATH TEACHERS
Note: This skill is seen as unimportant by all groups. Industrial and academic standards see it and other basic statistical competencies as important. This graph represents an incongruity that probably warrants further study.

SKILL #29: Understanding the logic of algebraic procedures



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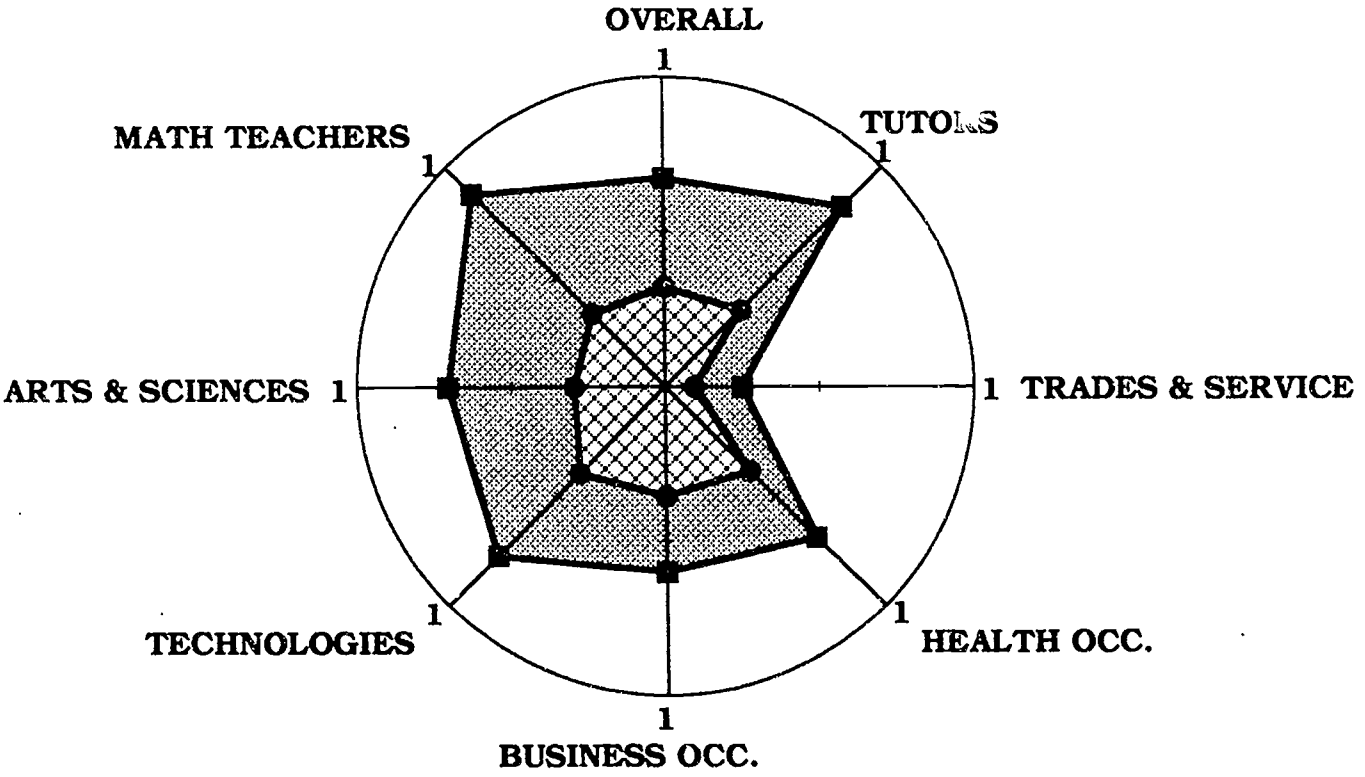
This skill is most important to: MATH TEACHERS; TUTORS
This skill is least important to: TRADES & SERVICE OCCUPATIONS
Greatest difference between "importance" and "performance:" MATH TEACHERS

SKILL #29: Understanding the logic of algebraic procedures



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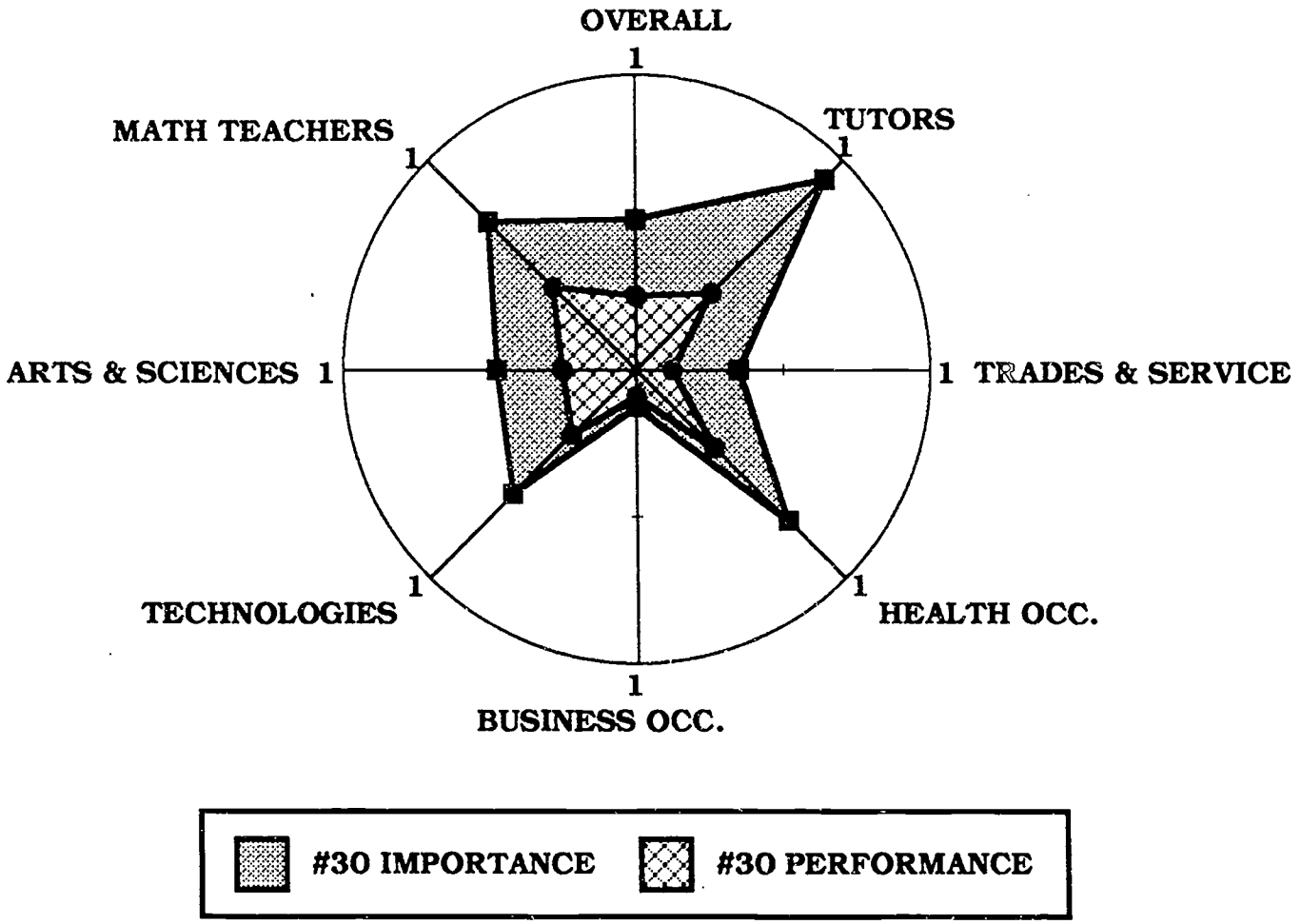
This skill is most important to: MATH TEACHERS; TUTORS
This skill is least important to: TRADES & SERVICE OCCUPATIONS
Greatest difference between "importance" and "performance:" MATH TEACHERS

SKILL #30: Making conversions using dimensional analysis



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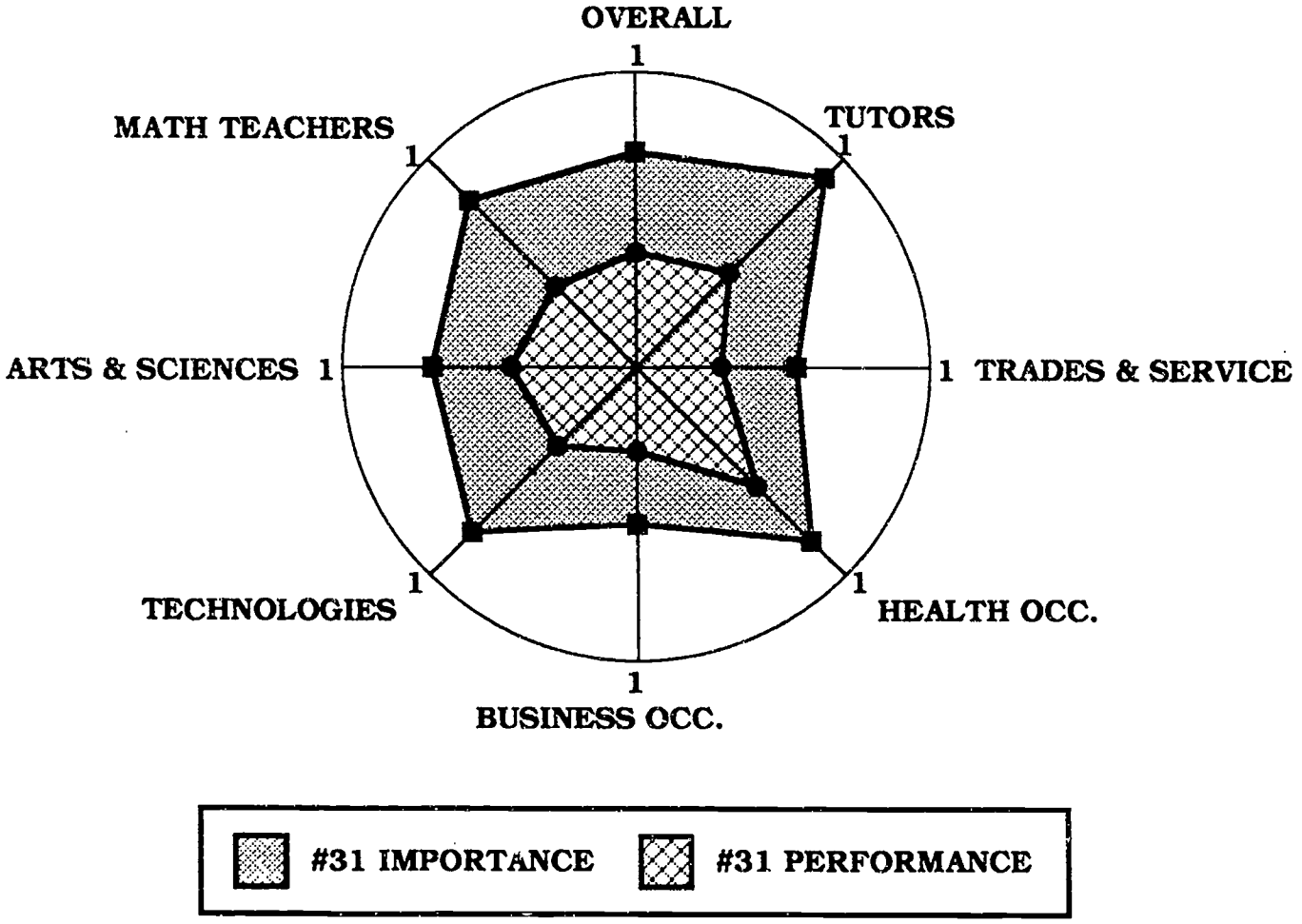
3. The larger the gap between the two points on an axis, the greater the disparity between "importance" and "performance."

This skill is most important to: TUTORS
This skill is least important to: BUSINESS OCCUPATIONS
Greatest difference between "importance" and "performance:" TUTORS

Note: Compare the "importance" rating of Arts & Sciences and the tutors.

SKILL #31: Understanding functional relationships as a way of understanding how a change in one quantity results in a change in another



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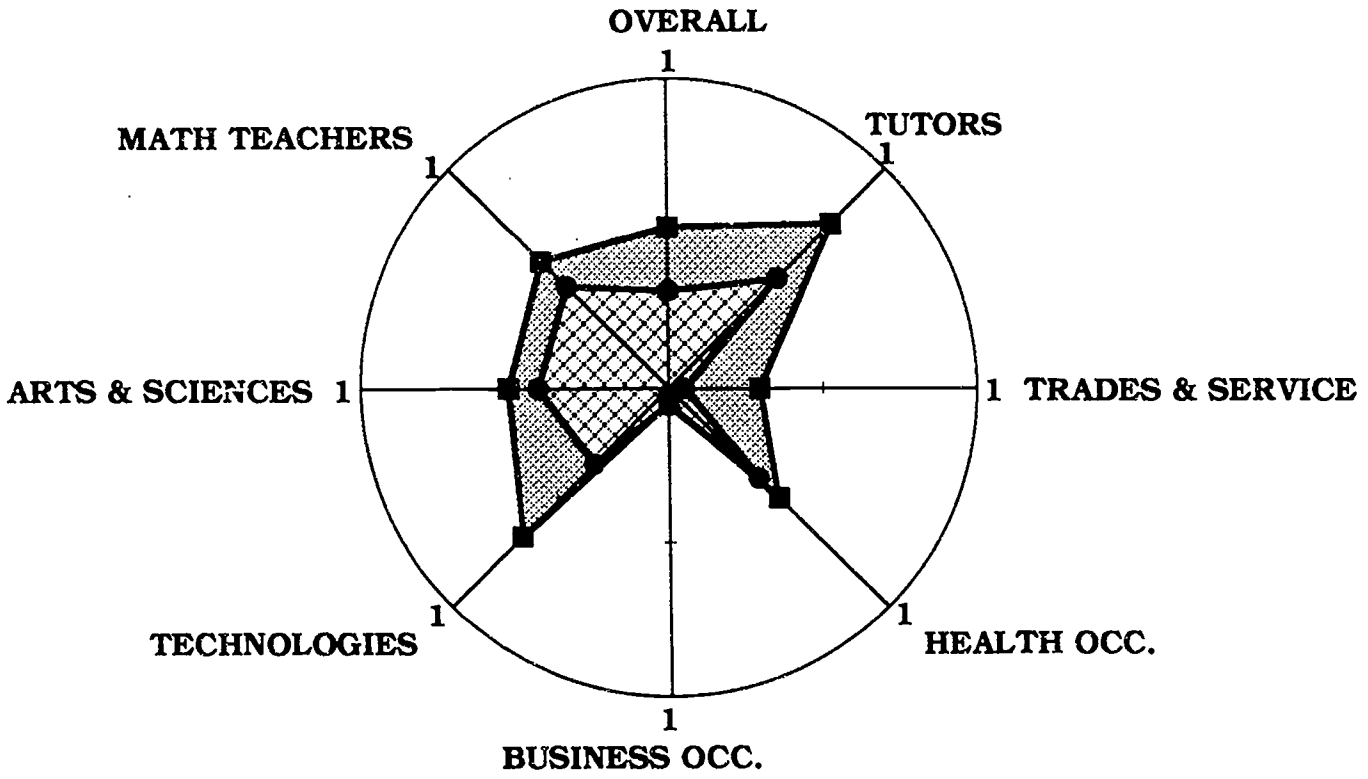
2. The closer the light pattern is to "1," the better the skill is performed.
3. The larger the gap between the two points on an axis, the greater the disparity between "importance" and "performance."

This skill is most important to: TUTORS
This skill is least important to: BUSINESS OCCUPATIONS; TRADES & SERVICE OCCUPATIONS
Greatest difference between "importance" and "performance:" TUTORS; MATH TEACHERS; TECHNOLOGIES

SKILL #32: Ability to apply scientific notation in problem situations



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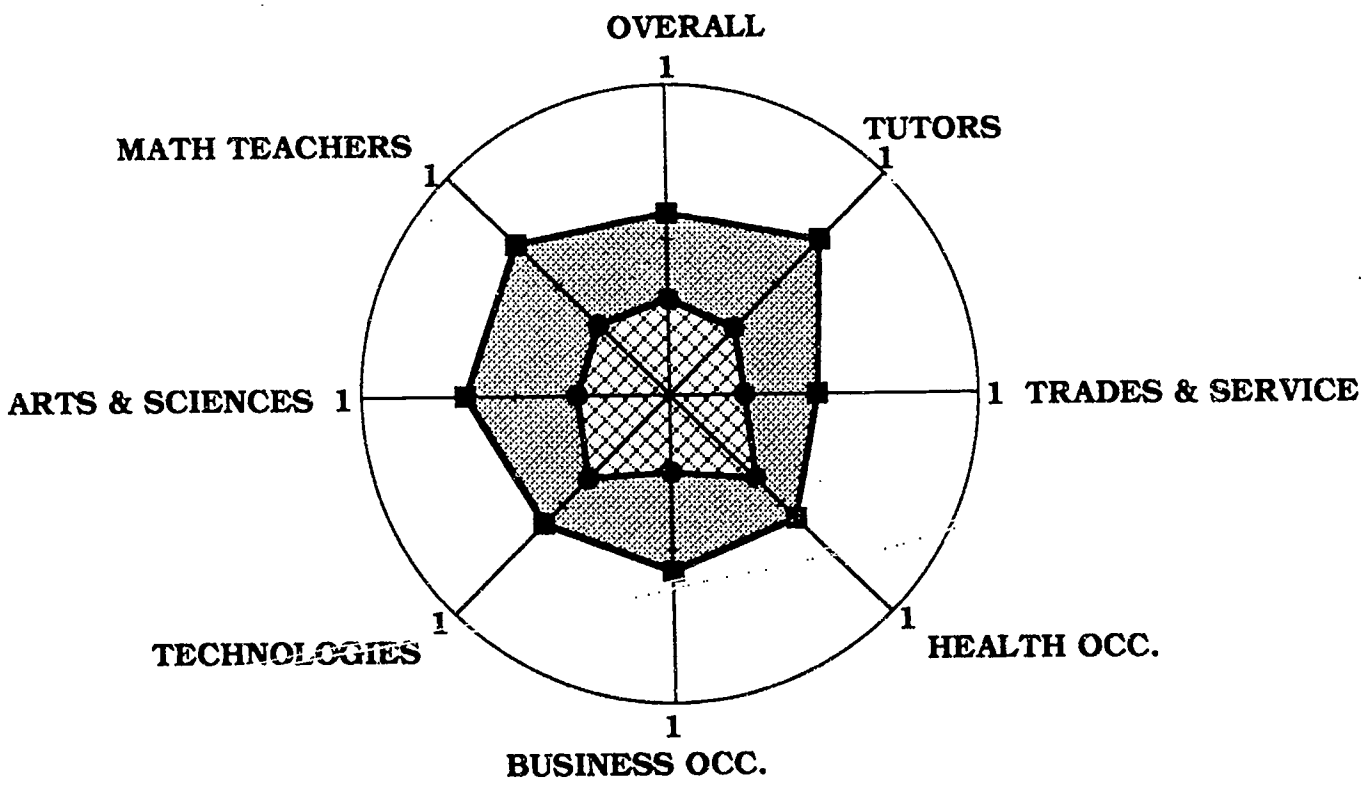
3. The larger the gap between the two points on an axis, the greater the disparity between "importance" and "performance."

This skill is most important to: TUTORS; TECHNOLOGIES
This skill is least important to: BUSINESS OCCUPATIONS
Greatest difference between "importance" and "performance:" TECHNOLOGIES

SKILL #33: Recognition of mathematical pattern and relationship in real-life situations



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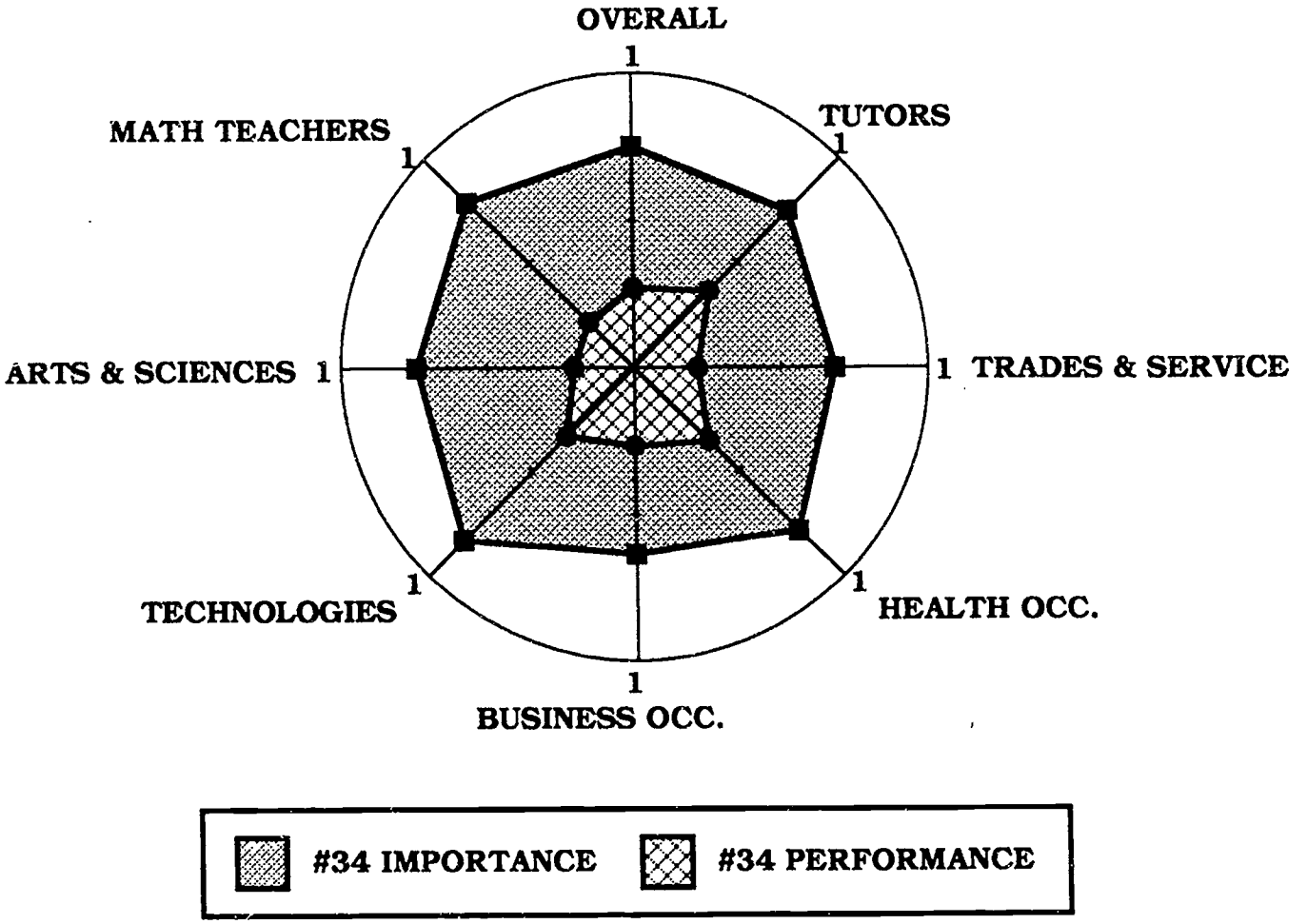
3. The larger the gap between the two points on an axis, the greater the disparity between "importance" and "performance."

This skill is most important to: TUTORS; ARTS & SCIENCES; MATH TEACHERS
This skill is least important to: TRADES & SERVICE OCCUPATIONS
Greatest difference between "importance" and "performance:" TUTORS; ARTS & SCIENCES; MATH TEACHERS

SKILL #34: Ability to generalize problem solutions to new problem situations



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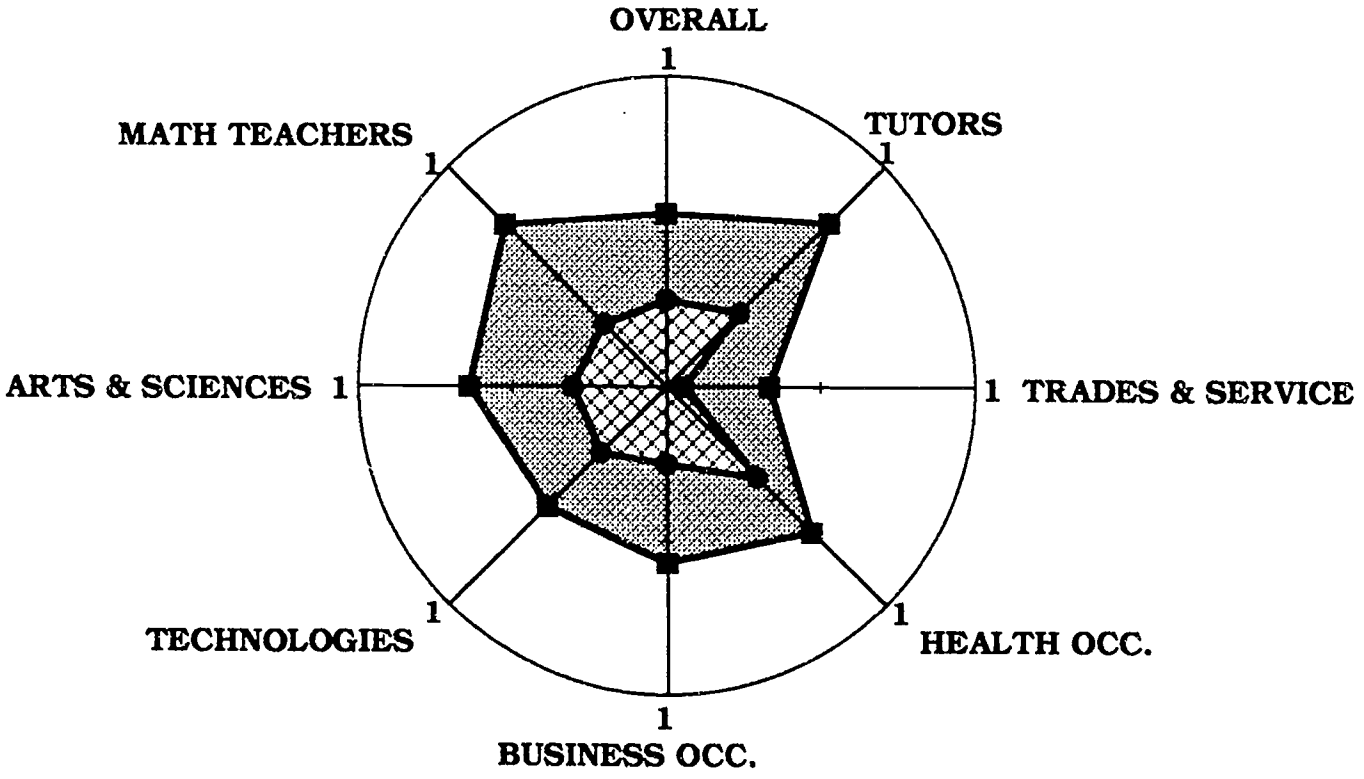
3. The larger the gap between the two points on an axis, the greater the disparity between "importance" and "performance."

This skill is most important to: MATH TEACHERS; TECHNOLOGIES
This skill is least important to: BUSINESS OCCUPATIONS
Greatest difference between "importance" and "performance:" MATH TEACHERS

Note: All groups perceive this skill to be important; all see it as being performed poorly.

SKILL #35: Developing and applying the concepts of rates and other indirect and/or derived measurements



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3. The larger the gap between the two points on an axis, the greater the disparity between "importance" and "performance."

This skill is most important to: MATH TEACHERS; TUTORS
This skill is least important to: TRADES & SERVICE OCCUPATIONS
Greatest difference between "importance" and "performance:" MATH TEACHERS

◆

The information contained in the graphs may stimulate many questions in the minds of those interested in the state of math instruction at T-VI. Several points seem clear:

OBSERVATIONS

- Several skills seen as important by creators of national standards are viewed as unimportant by considerable numbers of people who teach math or math-related subjects at T-VI. Examples include *working together in groups to solve problems; using calculators; ability to estimate; ability to use measuring tools and systems; ability to use simple statistical processes.*
- Different groups of instructors at T-VI have different views of some basic math skills. In other words, different departments have different math requirements and expectations.
- Conversely, there does seem to be a set of "basic math skills" that almost everybody agrees are important. These may form the basis of a core curriculum.
- The views of the Tutors concerning certain basic math skills are informative. For example, they see the use of *dimensional analysis* as very important, undoubtedly because it's so useful in chemistry and nursing. The tutors know the students from a different perspective than that of the instructors; therefore, their responses may warrant special attention.
- Some skills seen as generally important by most respondents are not usually addressed in the various math curricula at T-VI. For example, *the ability to generalize problem solutions to new situations; ability to apply a variety of strategies to the solution of a problem; ability to communicate in the language of math; possessing confidence in one's abilty to use math.* A brief analysis of the "T-VI Mathematics Advisement Test," which is the general admissions math test at T-VI, shows that **79%** of the test items are based on one of the thirty-five skills discussed in this report; that is, *Computing with whole numbers, fractions, decimals, integers and rational numbers* [plus percents]. The remaining 21% of the items test the ability to manipulate algebraic expressions. None of the other "basic skills" discussed in this survey or in any of the national standards reviewed are covered by T-VI's math admissions test.

RECOMMENDATIONS

- The appropriateness of "national standards" to the local labor and academic market should be investigated. A slightly modified version of this survey was sent to about twenty-five local employers, but the response was too small to be of much use. My feeling is that the standards summarized previously in this report

(and many other similar efforts at defining standards) do reflect the reality of today's economic and intellectual life. However, it may not be the case that local academic and economic employers of T-VI graduates share that view. We should find out.

- Developmental and preparatory math courses should be designed to fit the differing needs of different vocational and academic departments. In basic math, one size does not fit all.
- Staff development and teacher training to acquaint instructors with current thinking in math education should be implemented.
- Curricula, texts, and evaluative instruments should be reformed to reflect the math skills that industry, the academy and the faculty at T-VI see as important.
- Further research should be conducted to determine what math teaching methodologies and instructional strategies are favored and not favored by those who teach math and math-related subjects at T-VI. Regardless of the content of the curriculum, the interface in the classroom between instructor and student is where math learning takes place. It's necessary to know more about that exchange before we can make intelligent suggestions for reform and improvement.
- Since mathematics is the key to success in all scientific and technological fields, not to mention a necessity for well-informed and literate citizens, it may be time to consider the implications of reorganizing T-VI's Instructional Division so that "math" becomes a department of its own; one large enough to contain and coordinate mathematics instruction for all T-VI students at all levels and in all occupational and academic fields.

APPENDIX A

PARTICIPATION

A total of 445 surveys were distributed on January 14, 1994 to all T-VI vocational instructors and Arts & Sciences instructors identified as teaching math or math-related subjects as of the beginning of the Winter '94 trimester. Part-time instructors and instructional technicians were included in the departmental distributions. Math and science tutors were included. Completed surveys returned by April 1, 1994 are included in the analysis of the data.

I determined midway through the survey collection process that math is irrelevant to some Business Occupations courses; therefore, after consultation with the project representative in BOD, 23 BOD instructors were removed from the BOD list, and are not counted in the final "number distributed" or "returned."

An additional 51 instructors to whom surveys were distributed were found to be either not teaching at the time of survey distribution, no longer employed, or not teaching courses involving math during the Winter '94 trimester. They are not counted in the final "number distributed" or "returned."

The data on 5 surveys were not included because they were incomplete, obviously superfluous or hostile, were duplicates, or were unnamed and the department from which they came could not be identified. However, these surveys were counted in the final "number distributed" and "returned." (Data from surveys that were nameless but were identified with a department were included.)

Arts & Sciences: 84 surveys distributed; 38 returned; **45% response**
Business Occupations: 52 distributed; 30 returned; **58% response**
Health Occupations: 47 distributed; 17 returned; **36% response**
Technologies: 81 distributed; 43 returned; **53% response**
Trades & Service Occupations: 81 distributed; 31 returned; **38%** response
Tutors: 26 distributed; 16 returned; **62% response**

OVERALL TOTAL: 371 distributed; 175 returned; **47% response**

PROCEDURAL ISSUES

1. The "performance" question on the survey provided the options "good," "fair," and "none." 19% of survey respondents (34 out of 175) indicated in one way or another their view that the "none" option was unnecessarily absolute, and that the option "poor" should have been provided. I agree with this criticism. It may be that this shortcoming might distort the survey results somewhat. However, I think it's

clear that if results are distorted, student performance will appear better in the survey results that it actually is in the minds of the respondents. (People are likely to choose "fair" rather than "none" if the student demonstrates any performance at all, no matter how poor.) Therefore, where significant differences between perceived importance and perceived performance appear in the data, I think we can be confident that if the survey has erred, it has erred on the conservative side.

2. 4 surveys indicated that they were incomplete because the recipient felt unable to accurately respond to the "performance" question, usually because the recipient teaches many different levels of math. The "importance" responses on these surveys were counted.

3. 7 surveys demonstrated what I felt to be an apparent lack of understanding of the process, in that for all 35 skills surveyed, "importance" and "performance" were indicated to be the same. These recipients were called and interviewed (by a neutral party) in an attempt to discover whether or not the survey responses were genuine. It was determined that recipients did understand the process, so the surveys were counted as valid and the data in them included.

ACKNOWLEDGEMENTS

Six project representatives were instrumental in distributing and gathering surveys. They were James DeMarcus (Trades); Charles Fatta (Health Occupations); Hayward Franklin (Montoya Campus); Bob Hildenbrand (Business Occupations); Aaron Loggins (Technologies); and Bill Pletsch (Arts & Sciences).

Richard Delgado, the director of Testing Services at T-VI, offered much useful advice and many helpful suggestions as this project developed. I appreciate his patience and intelligence.

Ruth Tangman, T-VI's Associate Vice President for Instruction, supported the project wholeheartedly. It could not have happened without her help.

All these people helped provide the useful information this project contains. Whatever errors and mistakes it may contain are my responsibility.

NAME:_____

DEPARTMENT: _____

COURSE(S) TAUGHT:

Title	Number	Math Skill Required (low medium high)

For each item, consider both questions:

A. How important is it that students entering your program or course be able to perform this skill?
B. How well does the average student currently entering your program or course actually perform this skill?

Please circle your two responses for each item.

1. Ability to set up problems with the appropriate operations.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

2. Ability to work with others in a group to solve problems.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

3. Ability to apply a variety of strategies to the solution of a problem.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

4. Ability to use an electronic calculator as a problem-solving tool.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

5. Ability to apply arithmetic skills to common real-life problems.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

6. Ability to translate problem situations into mathematical expressions (i.e., communicate in the language of math)

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

7. Possessing confidence in one's ability to use math to solve problems.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

8. Ability to estimate or approximate likely solutions to simple problems with reasonable accuracy.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

9. Ability to use common measuring tools, scales and instruments.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

10. Understanding of length, weight, area, volume, time, temperature and angle.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

11. Demonstrating "number sense" for fractions, decimals and percents: equivalents, relative sizes, relationships, sequences, etc)

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

12. Using the skills of reading, listening and viewing to interpret and evaluate mathematical problems.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

13. Understanding and applying ratios, proportions and percents in a wide variety of real-life situations.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

14. Demonstrating "number sense" with positive and negative numbers.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

15. Understanding the order of operations and the relationships among the basic operations.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

16. Computing with whole numbers, fractions, decimals, integers and rational numbers.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

17. Ability to select appropriate methods of computing from among mental arithmetic, paper-and-pencil, calculator and/or computer.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

18. Understanding the concepts of variable, expression and equation.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

19. Ability to use algebraic concepts to manipulate and apply basic formulas.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

20. Constructing, reading and interpreting tables, charts and graphs.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

21. Understanding the structure and use of the metric and traditional systems of measurement.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

22. Ability to apply measures of central tendency (mean, median, mode) to real-life situations.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

23. Ability to represent and solve problems using geometric models.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

24. Expressing mathematical ideas orally and in writing.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

25. Understanding the connections between and applications of mathematics to other academic disciplines and vocational fields.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

The following items are optional. Please complete them if they are appropriate for your area of instruction.

26. Identifying, classifying, describing and comparing geometric figures.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

27. Ability to systematically collect, organize and describe data.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

28. Using the properties of the normal curve to answer questions about data that are assumed to be normally distributed.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

29. Understanding the logic of algebraic procedures.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

30. Making conversions using dimensional analysis.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

31. Understanding functional relationships as a way of understanding how a change in one quantity results in a change in another.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

32. Ability to apply scientific notation in problem situations.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

33. Recognition of mathematical pattern and relationship in real-life situations.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

34. Ability to generalize problem solutions to new problem situations.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

35. Developing and applying the concepts of rates and other indirect and/or derived measurements.

Important? 1. Vital 2. Useful 3. Unimportant
Performance? 1. Good 2. Fair 3. None

ITEM RESULTS BY GROUP

GROUPS	#1 IMPORTANCE	#1 PERFORMANCE	GROUPS	#2 IMPORTANCE	#2 PERFORMANCE
TUTORS AVERAGE	1.20	2.07	TUTORS AVERAGE	13	2.00
TRADES AVERAGE	1.45	2.00	TRADES AVERAGE	1.42	1.63
HEALTH AVERAGE	1.25	1.88	HEALTH AVERAGE	1.88	1.87
BOD AVERAGE	1.56	1.92	BOD AVERAGE	2.19	2.08
TECH AVERAGE	1.27	1.95	TECH AVERAGE	1.71	1.95
A&S AVERAGE	1.37	2.18	A&S AVERAGE	2.20	2.23
MATH AVERAGE	1.30	2.13	MATH AVERAGE	2.10	2.14
OVERALL #1	1.36	2.01	OVERALL #2	1.89	1.96

ITEM RESULTS BY GROUP

GROUPS	#3 IMPORTANCE	#3 PERFORMANCE	GROUPS	#4 IMPORTANCE	#4 PERFORMANCE
TUTORS AVERAGE	1.73	2.29	TUTORS AVERAGE	1.67	1.93
TRADES AVERAGE	1.52	2.07	TRADES AVERAGE	1.65	1.90
HEALTH AVERAGE	1.50	2.13	HEALTH AVERAGE	1.88	2.00
BOD AVERAGE	1.81	2.23	BOD AVERAGE	1.56	2.04
TECH AVERAGE	1.50	2.18	TECH AVERAGE	1.40	1.73
A&S AVERAGE	1.86	2.38	A&S AVERAGE	2.17	1.97
MATH AVERAGE	1.78	2.37	MATH AVERAGE	1.80	1.92
OVERALL #3	1.65	2.21	OVERALL #4	1.71	1.91

GROUPS	#5 IMPORTANCE	#5 PERFORMANCE	GROUPS	#6 IMPORTANCE	#6 PERFORMANCE
TUTORS AVERAGE	1.27	1.69	TUTORS AVERAGE	1.33	2.07
TRADES AVERAGE	1.42	2.00	TRADES AVERAGE	1.74	2.26
HEALTH AVERAGE	1.56	2.06	HEALTH AVERAGE	1.56	2.25
BOD AVERAGE	1.41	2.00	BOD AVERAGE	1.70	2.35
TECH AVERAGE	1.37	1.88	TECH AVERAGE	1.54	2.18
A&S AVERAGE	1.29	2.06	A&S AVERAGE	1.49	2.38
MATH AVERAGE	1.35	2.03	MATH AVERAGE	1.40	2.33
OVERALL #5	1.38	1.96	OVERALL #6	1.58	2.26

ITEM RESULTS BY GROUP

GROUPS	#7 IMPORTANCE	#7 PERFORMANCE
TUTORS AVERAGE	1.27	2.21
TRADES AVERAGE	1.58	2.35
HEALTH AVERAGE	1.44	1.94
BOD AVERAGE	1.63	2.30
TECH AVERAGE	1.41	2.24
A&S AVERAGE	1.60	2.33
MATH AVERAGE	1.45	2.33
OVERALL #7	1.51	2.26

GROUPS	#8 IMPORTANCE	#8 PERFORMANCE
TUTORS AVERAGE	1.53	2.29
TRADES AVERAGE	1.52	2.07
HEALTH AVERAGE	1.31	2.06
BOD AVERAGE	1.58	2.38
TECH AVERAGE	1.46	2.20
A&S AVERAGE	1.83	2.31
MATH AVERAGE	1.63	2.44
OVERALL #8	1.56	2.22

ITEM RESULTS BY GROUP

GROUPS	#9 IMPORTANCE	#9 PERFORMANCE	GROUPS	#10 IMPORTANCE	#10 PERFORMANCE
TUTORS AVERAGE	2.07	2.30	TUTORS AVERAGE	1.47	1.92
TRADES AVERAGE	1.29	2.00	TRADES AVERAGE	1.35	2.19
HEALTH AVERAGE	1.44	1.87	HEALTH AVERAGE	1.27	1.93
BOD AVERAGE	2.26	2.48	BOD AVERAGE	2.44	2.58
TECH AVERAGE	1.53	2.05	TECH AVERAGE	1.60	1.98
A&S AVERAGE	2.20	2.33	A&S AVERAGE	1.63	2.13
MATH AVERAGE	2.10	2.34	MATH AVERAGE	1.53	2.14
OVERALL #9	1.79	2.16	OVERALL #10	1.66	2.14

ITEM RESULTS BY GROUP

GROUPS	#11 IMPORTANCE	#11 PERFORMANCE	GROUPS	#12 IMPORTANCE	#12 PERFORMANCE
TUTORS AVERAGE	1.33	2.07	TUTORS AVERAGE	1.27	2.07
TRADES AVERAGE	1.23	2.29	TRADES AVERAGE	1.29	2.06
HEALTH AVERAGE	1.44	2.07	HEALTH AVERAGE	1.19	1.88
BOD AVERAGE	1.48	2.26	BOD AVERAGE	1.48	2.15
TECH AVERAGE	1.37	2.12	TECH AVERAGE	1.35	2.15
A&S AVERAGE	1.43	2.18	A&S AVERAGE	1.46	2.27
MATH AVERAGE	1.35	2.21	MATH AVERAGE	1.28	2.26
OVERALL #11	1.38	2.18	OVERALL #12	1.36	2.13

ITEM RESULTS BY GROUP

GROUPS	#13 IMPORTANCE	#13 PERFORMANCE	GROUPS	#14 IMPORTANCE	#14 PERFORMANCE
TUTORS AVERAGE	1.53	2.07	TUTORS AVERAGE	1.40	1.86
TRADES AVERAGE	1.48	2.10	TRADES AVERAGE	1.94	2.38
HEALTH AVERAGE	1.63	2.20	HEALTH AVERAGE	2.00	2.38
BOD AVERAGE	1.48	2.26	BOD AVERAGE	2.00	2.38
TECH AVERAGE	1.49	2.22	TECH AVERAGE	1.46	1.90
A&S AVERAGE	1.69	2.31	A&S AVERAGE	1.60	1.94
MATH AVERAGE	1.60	2.24	MATH AVERAGE	1.50	1.97
OVERALL #13	1.55	2.21	OVERALL #14	1.71	2.12

ITEM RESULTS BY GROUP

GROUPS	#15 IMPORTANCE	#15 PERFORMANCE	GROUPS	#16 IMPORTANCE	#16 PERFORMANCE
TUTORS AVERAGE	1.07	1.79	TUTORS AVERAGE	1.13	1.79
TRADES AVERAGE	1.65	2.19	TRADES AVERAGE	1.45	2.29
HEALTH AVERAGE	1.75	2.27	HEALTH AVERAGE	1.44	2.13
BOD AVERAGE	1.59	2.19	BOD AVERAGE	1.44	2.30
TECH AVERAGE	1.15	1.88	TECH AVERAGE	1.22	1.93
A&S AVERAGE	1.46	2.00	A&S AVERAGE	1.47	1.94
MATH AVERAGE	1.33	1.92	MATH AVERAGE	1.30	2.05
OVERALL #15	1.43	2.04	OVERALL #16	1.37	2.07

GROUPS	#17 IMPORTANCE	#17 PERFORMANCE	GROUPS	#18 IMPORTANCE	#18 PERFORMANCE
TUTORS AVERAGE	1.67	2.00	TUTORS AVERAGE	1.60	2.07
TRADES AVERAGE	1.67	2.17	TRADES AVERAGE	1.94	2.53
HEALTH AVERAGE	1.63	2.06	HEALTH AVERAGE	1.81	2.06
BOD AVERAGE	1.70	2.22	BOD AVERAGE	2.08	2.54
TECH AVERAGE	1.66	2.12	TECH AVERAGE	1.44	2.17
A&S AVERAGE	2.03	2.14	A&S AVERAGE	1.57	2.25
MATH AVERAGE	1.73	2.16	MATH AVERAGE	1.53	2.23
OVERALL #17	1.74	2.14	OVERALL #18	1.71	2.30

ITEM RESULTS BY GROUP

GROUPS	#19 IMPORTANCE	#19 PERFORMANCE	GROUPS	#20 IMPORTANCE	#20 PERFORMANCE
TUTORS AVERAGE	1.07	2.08	TUTORS AVERAGE	1.47	2.14
TRADES AVERAGE	1.84	2.58	TRADES AVERAGE	1.58	2.19
HEALTH AVERAGE	1.75	2.38	HEALTH AVERAGE	1.63	2.25
BOD AVERAGE	1.96	2.44	BOD AVERAGE	1.74	2.27
TECH AVERAGE	1.23	2.05	TECH AVERAGE	1.37	2.10
A&S AVERAGE	1.54	2.26	A&S AVERAGE	1.46	2.13
MATH AVERAGE	1.33	2.18	MATH AVERAGE	1.60	2.32
OVERALL #19	1.57	2.29	OVERALL #20	1.52	2.17

ITEM RESULTS BY GROUP

GROUPS	#21 IMPORTANCE	#21 PERFORMANCE	GROUPS	#22 IMPORTANCE	#22 PERFORMANCE
TUTORS AVERAGE	1.64	2.25	TUTORS AVERAGE	2.29	2.42
TRADES AVERAGE	1.97	2.41	TRADES AVERAGE	2.52	2.72
HEALTH AVERAGE	1.25	1.94	HEALTH AVERAGE	2.19	2.38
BOD AVERAGE	2.63	2.77	BOD AVERAGE	2.15	2.56
TECH AVERAGE	1.66	2.10	TECH AVERAGE	2.22	2.50
A&S AVERAGE	1.94	2.28	A&S AVERAGE	2.20	2.46
MATH AVERAGE	2.08	2.34	MATH AVERAGE	2.23	2.57
OVERALL #21	1.90	2.29	OVERALL #22	2.26	2.53

ITEM RESULTS BY GROUP

GROUPS	#23 IMPORTANCE	#23 PERFORMANCE	GROUPS	#24 IMPORTANCE	#24 PERFORMANCE
TUTORS AVERAGE	2.07	2.23	TUTORS AVERAGE	1.20	2.14
TRADES AVERAGE	2.29	2.70	TRADES AVERAGE	1.81	2.39
HEALTH AVERAGE	2.25	2.38	HEALTH AVERAGE	2.00	2.38
BOD AVERAGE	2.81	2.77	BOD AVERAGE	1.88	2.32
TECH AVERAGE	2.03	2.41	TECH AVERAGE	1.59	2.22
A&S AVERAGE	2.00	2.52	A&S AVERAGE	1.71	2.47
MATH AVERAGE	2.03	2.51	MATH AVERAGE	1.50	2.36
OVERALL #23	2.23	2.52	OVERALL #24	1.71	2.33

ITEM RESULTS BY GROUP

GROUPS	#25 IMPORTANCE	#25 PERFORMANCE	GROUPS	#26 IMPORTANCE	#26 PERFORMANCE
TUTORS AVERAGE	1.33	2.50	TUTORS AVERAGE	1.89	1.86
TRADES AVERAGE	1.84	2.38	TRADES AVERAGE	2.14	2.62
HEALTH AVERAGE	2.00	2.33	HEALTH AVERAGE	2.75	2.83
BOD AVERAGE	1.96	2.44	BOD AVERAGE	2.71	2.64
TECH AVERAGE	1.48	2.13	TECH AVERAGE	2.04	2.27
A&S AVERAGE	1.71	2.47	A&S AVERAGE	2.05	2.25
MATH AVERAGE	1.50	2.41	MATH AVERAGE	1.91	2.19
OVERALL #25	1.71	2.35	OVERALL #26	2.20	2.40

ITEM RESULTS BY GROUP

GROUPS	#27 IMPORTANCE	#27 PERFORMANCE	GROUPS	#28 IMPORTANCE	#28 PERFORMANCE
TUTORS AVERAGE	1.55	2.44	TUTORS AVERAGE	2.00	2.43
TRADES AVERAGE	1.82	2.38	TRADES AVERAGE	2.75	2.93
HEALTH AVERAGE	1.64	2.43	HEALTH AVERAGE	2.30	2.78
BOD AVERAGE	1.44	2.19	BOD AVERAGE	2.46	2.64
TECH AVERAGE	1.26	2.23	TECH AVERAGE	2.17	2.52
A&S AVERAGE	1.61	2.46	A&S AVERAGE	2.30	2.68
MATH AVERAGE	1.50	2.35	MATH AVERAGE	2.14	2.72
OVERALL #27	1.52	2.34	OVERALL #28	2.35	2.66

ITEM RESULTS BY GROUP

GROUPS	#29 IMPORTANCE	#29 PERFORMANCE	GROUPS	#30 IMPORTANCE	#30 PERFORMANCE
TUTORS AVERAGE	1.42	2.30	TUTORS AVERAGE	1.17	2.27
TRADES AVERAGE	2.26	2.81	TRADES AVERAGE	2.30	2.75
HEALTH AVERAGE	1.64	2.21	HEALTH AVERAGE	1.50	2.25
BOD AVERAGE	1.80	2.29	BOD AVERAGE	2.75	2.82
TECH AVERAGE	1.47	2.21	TECH AVERAGE	1.82	2.37
A&S AVERAGE	1.60	2.41	A&S AVERAGE	2.10	2.50
MATH AVERAGE	1.33	2.39	MATH AVERAGE	1.61	2.24
OVERALL #29	1.70	2.38	OVERALL #30	1.96	2.48

ITEM RESULTS BY GROUP

GROUPS	#31 IMPORTANCE	#31 PERFORMANCE	GROUPS	#32 IMPORTANCE	#32 PERFORMANCE
TUTORS AVERAGE	1.18	2.10	TUTORS AVERAGE	1.54	2.00
TRADES AVERAGE	1.91	2.42	TRADES AVERAGE	2.41	2.90
HEALTH AVERAGE	1.31	1.85	HEALTH AVERAGE	2.00	2.18
BOD AVERAGE	1.93	2.43	BOD AVERAGE	2.91	2.89
TECH AVERAGE	1.40	2.21	TECH AVERAGE	1.66	2.31
A&S AVERAGE	1.61	2.15	A&S AVERAGE	1.97	2.15
MATH AVERAGE	1.40	2.25	MATH AVERAGE	1.84	2.07
OVERALL #31	1.57	2.21	OVERALL #32	1.99	2.38

ITEM RESULTS BY GROUP

GROUPS	#33 IMPORTANCE	#33 PERFORMANCE	GROUPS	#34 IMPORTANCE	#34 PERFORMANCE
TUTORS AVERAGE	1.64	2.40	TUTORS AVERAGE	1.50	2.27
TRADES AVERAGE	2.04	2.52	TRADES AVERAGE	1.63	2.57
HEALTH AVERAGE	1.87	2.21	HEALTH AVERAGE	1.43	2.29
BOD AVERAGE	1.86	2.50	BOD AVERAGE	1.73	2.47
TECH AVERAGE	1.84	2.23	TECH AVERAGE	1.36	2.33
A&S AVERAGE	1.67	2.40	A&S AVERAGE	1.52	2.59
MATH AVERAGE	1.67	2.37	MATH AVERAGE	1.41	2.53
OVERALL #33	1.83	2.37	OVERALL #34	1.51	2.44

GROUPS	#35 IMPORTANCE	#35 PERFORMANCE
TUTORS AVERAGE	1.50	2.33
TRADES AVERAGE	2.33	2.82
HEALTH AVERAGE	1.69	2.15
BOD AVERAGE	1.86	2.50
TECH AVERAGE	1.90	2.39
A&S AVERAGE	1.77	2.39
MATH AVERAGE	1.56	2.44
OVERALL #35	1.89	2.44

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