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ABSTRACT

Forest Grove High School (FGHS) is a suburban school in Oregon that implemented an extensive remediation program to increase the mathematics scores of its learners taking the state-mandated competency examination, the Oregon Statewide Assessment Test (OSAT). Learners who failed at least two of the mathematics sections of the 1998 OSAT, taken when they were in the eighth grade, were enrolled in a High Intensity Learning Lab (HILL) for remediation that included the use of the PLATO computer learning system. The 2000 OSAT mathematics score for sophomores assigned to the HILL increased from 228 to 232.1. This gain was more than two times larger than that of the general learner population who did not use PLATO. In the general learner population, among those not using PLATO, percentile ranking declined from 54% to 45%, but PLATO users' percentile rank remained at 41%. However, due to a change in the cutoff scores for the OSAT, a higher pass rate did not result. Only 37% of the 10th graders in Oregon had a passing 2000 OSAT mathematics score. A significant positive relationship was identified between PLATO module mastery and the 2000 OSAT test. Learners (n=38) and teachers generally liked the PLATO system, and the FGHS principal and PLATO instructor believed that PLATO contributed to learner improvement on the OSAT. Appendixes contain the instructor survey results, graphs of OSAT achievement data, and the learner survey results. (Contains 6 tables and 33 figures.) (Author/SLD)

PLATO®

Evaluation Series

Forest Grove High School

Forest Grove, Oregon

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Executive Summary

Forest Grove High School (FGHS) is a suburban school that implemented an extensive remediation program to increase the math scores of their learners taking the state-mandated competency exam, OSAT. Learners who failed at least two of the math sections of the 1998 OSAT (taken when they were in 8th grade) were enrolled in a PLATO-supported High Intensity Learning Lab (HILL) for remediation.

The 2000 OSAT math scores for all sophomores assigned to the HILL – including these failing learners - increased from 228 to 232.1. These gains were more than two times larger than those of the general learner population who did not use PLATO. In the general learner population, who did not use PLATO, percentile ranking declined from 54% to 45%. By contrast, the PLATO users' percentile rank remained the same at 41%. However, due to a change in the cutoff scores for the OSAT, a higher pass rate did not result. Only 37% of 10th graders in Oregon had a passing 2000 OSAT math score.

The purpose of this evaluation report is to describe the manner in which the PLATO system has been used within the Math remediation courses at FGHS, to examine the effectiveness of the OSAT remediation effort, and to suggest possible areas of improvement for future PLATO implementation and use. Some of the more important results of this evaluation include:

- Learner OSAT scores increased significantly.
- A significant positive relationship was identified between PLATO module mastery and the 2000 OSAT test.
- Learners reported that the computer lessons made them feel more confident about doing well in school.
- Learners generally agreed that PLATO was easy to use, easy to understand, allowed them to work at their own pace, and they tried hard to learn from their assigned the PLATO modules.
- The FGHS principal and PLATO instructor believed that PLATO contributed to learner improvement on the OSAT courses and generally were positive about the software.

Six tables are included in the evaluation which detail OSAT test results and instructor and learner attitude survey results. Suggestions are outlined for maximizing the effectiveness of future PLATO use at FGHS.

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Forest Grove High School

Introduction

This report describes the PLATO-supported strategies used by Forest Grove High School, Forest Grove OR, to remediate learners who failed to earn a passing score on the math portion of the Oregon Statewide Assessment Test (OSAT)[1]. Learners must pass the OSAT in 10th grade to receive the Certificate of Initial Mastery (CIM) in math and language arts (science and social studies will be phased in by 2002 and 2003 respectively). This certificate was established in 1997. Learners in the class of 2002 are the second class subjected to this OSAT requirement and as 8th graders in 1998, over 60 percent of this class failed the OSAT. In 1997, nearly 60 percent of this class failed at least one part of the OSAT. This performance led FGHS, along with all high schools in the state, to devise an effective remediation plan to raise the OSAT scores for math and language arts on the spring 1999 and 2000 test. The remediation effort of the 2001 FGHS class is the focus of this evaluation report. This report evaluates the general effectiveness of the school's remediation strategy – which included both PLATO interventions and traditional classroom instruction. According to the instructor, the HILL/PLATO lab was the only remaining strategy to raise learner scores other than a tighter curriculum alignment of math curriculum.

FGHS serves a middle and lower-middle class learner population with about 30% of learner population on the free or reduced federal lunch program. Hispanics are the main minority group, comprising about 20% of the learner population.

FGHS began using PLATO in 1997-98 to develop personalized learner curriculum for the expressed purpose of OSAT test remediation. After the 1997 OSAT results, all learners who failed at least one part of the test were required to enroll in the newly created PLATO High Intensity Learning Lab for remediation. This effort continued in the following school year, 1998-99. Learners who did not have a composite score of 237 or higher on their 1998 8th grade OSAT math multiple-choice test were assigned to the lab. This criterion was derived by targeting learners who fell within 2 standard deviations from the 8th grade passing score of 231 (at the 47th percentile ranking). The school targeted learners, who had scores of 237 (67th percentile) or lower. The lower end (225) was dropped so that *all* learners below the 237 whose scheduling allowed (by being enrolled in study hall) were included in the HILL program.

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[1] This report is an update and expansion of Bob Hannafin and David Opperman's earlier report on Forest Grove High School.

PLATO Pathways was implemented to meet the following instructional needs:

- Align the curriculum to the Oregon Content Standards
- Address the remediation needs of each learner, since each comes into the program with a wide range of previous experiences and skill levels
- Enable instructors to establish learning programs that present a variety of computer-based modules correlated to math and language arts
- Provide a motivational way to learn core subject material
- Provide individual assessment and tracking

The purpose of this evaluation report is to describe the manner in which the PLATO Pathways program has been used in High Intensity Learning Lab (HILL) at FGHS, to examine the effectiveness of the OSAT remediation effort, and to suggest possible areas of improvement for future PLATO implementation and use. This evaluation also will attempt to determine the relationship between the completion of aligned computer assisted instruction and improved performance on the math portion of the OSAT.

Program Description

Learners. Approximately 70% of the FGHS class of 2001 had failed one or both parts of the 1997 OSAT and were automatically enrolled in the High Intensity Learning Lab. Approximately 60% of the FGHS class of 2002 had failed the math portion of the 1998 OSAT and were automatically enrolled in the High Intensity Learning Lab.

Program Goals. The goal for using PLATO, and the focus of this report, was to help increase the passing rate for learners who have already failed the math components of the OSAT.

According to Mr. Robert Schlegel, Principal - FGHS and Dr. Jan Jones, Director of Curriculum and Instruction - Forest Grove School District, it was originally decided to assign curriculum in the lab according to individual learner achievement. Curriculum would be assigned to learners according to the results of the 8th grade OSAT scores for math and reading/literature. These two tests were selected as the initial focus of the lab with the understanding that supplemental curriculum for performance-based goals such as writing and mathematical problem solving would be given future consideration. Other learners were accepted to enroll in the lab; it was not exclusively used for OSAT remediation.

The next step in the project was to create an alignment between the Oregon content standards and the PLATO curriculum. This involved dissecting the Oregon benchmarks into smaller components and matching the PLATO learning objectives. Each benchmark for math was created as a course containing an average of twenty (20) modules.

A PLATO module is based on a single learning objective containing three activities: a tutorial that teaches the concept, an application that provides additional practice and one or more mastery tests, which must be eighty percent (80%) correct in order to demonstrate mastery. Learners not achieving eighty percent (80%) mastery are guided back through the tutorial before they can retake the mastery tests. No problem-solving activities (PSA's) from the Math Problem Solving curriculum, and no non-PLATO learning activities were implemented in this program, though it did not displace their normally scheduled math class. All learners in the class of 2002 whose scheduling allowed were assigned the aligned course work for each benchmark in which they had received a failing score on the 1998 OSAT (taken in 8th grade).

Learners were scheduled to attend a forty-five (45) minute session in the lab during their ninety (90) -minute resource block, which occurred every

other school day according to the block schedule. The HILL program implements each aspect of PLATO's Skills Development Model.[2]

Instructor Characteristics and Role in Program. Mr. David Opperman was the instructor and taught in the High Intensity Learning Lab. The task of the instructor was to design and align the curriculum with state benchmarks and FGHS's overall goals. His role was to facilitate, to the extent possible, each learner's curriculum, answer content questions, manage module mastery and testing, and troubleshoot technical problems in the lab. Mr. Opperman continually interacted with HILL learners individually. He helped problem-solve individual math problems and provided motivational support. He occasionally added PLATO modules for individual learners if he thought a particular content area needed to be mastered by a learner.

PLATO Implementation Description

A concerted effort to use PLATO to increase the OSAT passing rate was undertaken in the 1997-98 academic year and continued in the 1998-99 academic year. Learners in need of remediation were enrolled in the HILL and then placed in PLATO modules. Once placed in the OSAT-aligned PLATO curriculum, learners then worked at their own pace through the curriculum, advancing to the next module after passing the module mastery test. Mr. Opperman facilitated learner progress individually.

Content standards in Oregon are organized into specific goals called benchmarks, which define what is to be achieved by learners at grades 3, 5, 8 and 10. The benchmarks for mathematics are: calculation/estimation, measurement, probability and statistics, algebraic relations, geometry and mathematical problem solving. These benchmarks are measured by the multiple choice OSAT, except for mathematical problem solving, which is measured by a performance-based assessment.

In 1997-98, the first year of the FGHS remediation effort, the curriculum emphasis in the HILL was equally split between math and language arts. But the strategy shifted in the second year to place greater emphasis on math because Mr. Schlegel and faculty were concerned with the low math scores of the 1997-98 sophomores (rising seniors) in the spring 1998 OSAT. This effort continued with the learners in the class of 2002.

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[2] For more information about this model, see Foshay, R., Instructional models: Four ways to integrate PLATO into the curriculum. Technical Paper #6: Edina, MN: PLATO Learning, Inc., 2000.

Evaluation Design

The present evaluation examines elements of the implementation using a design which is somewhat consistent with both a modified Mastery-Based Program Effectiveness design and an Affective Outcomes design.[3] PLATO module-mastery and time-in-program data were analyzed. In addition, the learner OSAT scores from 1998 and 2000 were examined, as well as program description and affective outcome data were collected.

Learners who met the following criteria were included in the analysis:

- Learners who did not meet at least two benchmarks for the math portions of the OSAT
- Learners who were assigned at least forty modules in math
- Learners who completed 70% of the assigned course work in math.

In 1997, learners originally were assigned to the HILL for both math and English based on their 8th grade OSAT results, but after the first year, emphasis was shifted away from English in favor in math in response to poor math scores school-wide. Thus, only the math PLATO module data and math OSAT results were analyzed in this quantitative portion of this evaluation. Learner OSAT scores were examined for all Forest Grove 10th graders for whom scores were available for both the 8th and 10th grades.

Affective outcomes were measured with questionnaires completed by FGHS faculty and learners. In addition, a telephone interview was conducted with the principal, Mr. Robert Schlegel.

The current evaluation primarily examined learners in the class of 2002 (rising juniors) who were enrolled in the HILL. Most of this group of learners participated in the concerted remediation effort with extensive use of PLATO; the rest of the group used PLATO for other purposes but still took the OSATs in both years under examination. Examining this group of learners offers the most promise for determining how successful the OSAT remediation effort has been, and to what extent PLATO has contributed in that success.

The number of learners enrolled in the HILL was approximately 200 for both 1997-98 and 1998-99. The group of Forest Grove learners who were not enrolled in HILL provides somewhat of a comparison group. By comparing these two groups, the design requires that their results differ from each other by a certain amount in order to determine the difference is not due to chance alone.

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[3] Foshay, R., *Guidelines for Evaluating Programs Using PLATO.* Technical Paper #2: Edina, MN: TRO Learning, Inc., 1994.

The PLATO module data (module mastery, time in program) for learners who worked in the HILL were correlated to the OSAT test scores. The evaluation seeks to examine relationships among several variables as well as describe a rich picture of participant attitudes and beliefs.

Data Analysis

Results of instructor and learner surveys are reported. For open-ended survey items, similar responses are summarized and reported. In reporting the interview results, common threads and main ideas were collapsed and summarized. In the quantitative analysis, correlations were performed and reported at the .05 alpha level of significance. That is, there had to be a 95% likelihood that the correlations were not due to random variation, in order for them to be considered in the conclusions.

Differences in OSAT scores were analyzed using a paired sample *t*-test, again at the .05 level. In other words, learner gain scores were examined to determine if the gains were likely due to the FGHS's HILL intervention or are a result of random fluctuation. The analysis is focused on those sophomores whose OSAT scores were available from both 8th and 10th grades.

Procedures for data collection

The evaluator used the PLATO site overview questions[4] to structure the phone interviews, and then allowed the inquiry to be guided by the concerns and perspectives of the participants. Mr. Opperman administered the learner surveys to the classes that used PLATO, completed the instructor survey himself, and forwarded all data to the evaluator. Unfortunately, only 38 learners returned completed learner surveys because the surveys were administered during the last days of the school year. Mr. Opperman also provided comprehensive PLATO records of all HILL learners, and learner scores for the past two OSATs, which were used in the current analysis.

Results

The results are organized into two sections, OSAT scores and Attitudes/Beliefs. The OSAT scores section examines the OSAT scores for the rising juniors who participated in the HILL over the last two years. These learner scores were analyzed for tests administered in 1998 and 2000. In addition, Pearson product moment correlations were calculated between the PLATO module data and the math components of the OSAT administered in Spring 2000. Graphs supporting this analysis are in Appendix B. The Attitudes/Beliefs section presents the attitude questionnaire data for the instructor (Mr. Opperman) and learners, and descriptions of the telephone interviews with Mr. Schlegel and Mr. Opperman. The data tabulation and graphs for this section are in Appendix A and Appendix C.

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[4] Part of guidelines to evaluators – *ed.*

Table 1a and 1b displays learner mean scores for the math component of the OSATs administered in 1998 and 2000. Test scores from these dates are important to examine because the 1998 scores predate all of the OSAT remediation efforts initiated by FGHS, and the 2000 test was administered after the OSAT remediation courses were in place for almost two years. PLATO users include learners who participated in the OSAT remediation courses as freshmen and sophomores. Non-PLATO users include all other Forest Grove sophomores who were not assigned to the HILL and for whom there were OSAT scores available for both 1998 and 2000.

Table 1a. Mean OSAT 1998 and 2000 scores

Users		OSAT scores 1998	OSAT scores 2000
PLATO users	M SD N	228.08 (7.93) 146	232.16 (9.36) 146
Non-PLATO users	M SD N	232.13 (12.64) 85	233.80 (14.45) 85
Total FGHS learner scores	M SD N	229.57 (10.09) 231	232.76 (11.49) 231

Table 1b. Mean OSAT 1998 vs. 2000 gain scores

Users		OSAT score - gain
PLATO users	M SD N	4.08 (5.4) 146
Non-PLATO users	M SD N	1.67 (6.33) 85
Total	M SD N	3.19 (5.86) 231

Paired-sample *t*-tests revealed that learner OSAT scores on the 2000 test increased significantly over the 1998 test for both PLATO users and non-PLATO users. PLATO users increased from a mean score of 228.08 to a mean score of 232.16, for a gain score of 4.08 points, t(df145)=-9.125 p<.000 (effect size = .19). Non-PLATO users increased from a mean score of 232.13 to a 233.8, for a gain score of 1.67 points, t(df84) = -2.434 p<.017 (effect size = .19). Gains on the 2000 OSAT of the HILL learners were nearly three times larger than other learners (see table 1b).

Because the passing score was raised from 231 to 239, fewer learners met the standard in 2000. In 1998 as eighth graders, 91 of the total 231 learners for whom OSAT scores are available, met the 231 OSAT minimum standard - about a 39 % pass rate. Of those 140 learners who failed, 103 were assigned to the HILL and the other 37 took the regular math curriculum. In 2000, only 65 of the 231 learners for whom 2000 OSAT scores are available, met the higher 239 OSAT minimum standard

- about a 28 % pass rate. Of those 65 passing learners, 30 had worked in HILL and the other 35 had worked in the regular math curriculum.

Running an one-way analysis of variance, there was a significant difference between PLATO learners' post-OSAT scores and non-PLATO learners' post-OSAT scores $F(48,182) = 1.467$, $p<.038$. Apparently, FGHS learners, who were enrolled in the HILL program (146 learners), significantly improved their OSAT 2000 scores, compared to their non-HILL counterparts (85 learners).

Strands data results

The following tables report the average gains for PLATO and non-PLATO learners for the five strands (i.e., Calculation/Estimation, Algebraic Relations, Geometry, Measurement, and Statistics). Learners were counted as PLATO users if they had completed at least 70% of the assigned strands. HILL users in the Calculation/Estimation strand gained more than two times that of their counterparts. HILL users in the Algebraic Relations strand gained more than four times than their counterparts. HILL users in the Geometry strand gained nearly eight times more than their counterparts. HILL users in the Measurement strand gained over six times more than their counterparts. HILL users in the Statistics strand gained nearly eight times more than their counterparts. See table 2 for more information on these gains, and Appendix B for graphs of the data.

Table 2. OSAT gains – PLATO and non-PLATO users

Users		**OSAT scores 2000 - gain**
PLATO users Calculation/Estimation	M SD N	4.06 (10.59) 109
Non-PLATO users Calculation/Estimation	M SD N	1.94 (12.82) 122
PLATO users Algebraic Relations	M SD N	3.15 (11.2) 86
Non-PLATO users Algebraic Relations	M SD N	-.48 (14.02) 145

Table 2 (cont'd). OSAT gains – PLATO and non-PLATO users

Users		**OSAT scores 2000 – gain**
PLATO users Geometry	M SD N	7.93 (12.71) 84
Non-PLATO users Geometry	M SD N	1.01 (12.73) 149
PLATO users Measurement	M SD N	6.98 (11.07) 48
Non-PLATO users Measurement	M SD N	1.57 (12.62) 183

Table 2 (cont'd). OSAT gains – PLATO and non-PLATO users

Users		**OSAT scores 2000 – gain**
PLATO users Statistics	M SD N	8.54 (10.25) 56
Non-PLATO users Statistics	M SD N	1.63 (12.29) 175

T-Tests – Strands

Paired-sample t-tests revealed that learner OSAT sub-scale score gains on the 2000 test increased significantly over the 1998 test for PLATO users for the following HILL strands:

- PLATO users for the Calculation and Estimation strand increased from a mean score of 228.02 to a mean score of 232.08, for a gain score of 4.06 points, t(df 108)=-4.008 p<.000.
- PLATO users for the Algebraic Relations strand increased from a mean score of 229.55 to a mean score of 232.70, for a gain score of 3.15 points, t(df 85)= -2.607 p<.011.
- PLATO users for the Geometry strand increased from a mean score of 228.33 to a mean score of 236.26, for a gain score of 7.93 points, t(df 83)= -5.718 p<.000.
- PLATO users for the Measurement strand increased from a mean score of 224 to a mean score of 230.98, for a gain score of 6.98 points, t(df 47)= -4.368 p<.000.
- PLATO users for the Statistics strand increased from a mean score of 225.21 to a mean score of 233.75, for a gain score of 8.54 points, t(df 55)= -6.229 p<.000.

Paired-sample t-tests also were run for non-PLATO users for each of the strands. However, there were no significant results for these t-tests, indicating that non-PLATO users made no significant gains over the two years in any of the strands.

In addition to the HILL's five OSAT strands, data was analyzed from PLATO learners who completed advanced PLATO modules, such as Intermediate Algebra, Geometry 2 and a combination of these modules. Intermediate Algebra and Geometry 2 learners were counted as PLATO users if they completed at least 70% of the assigned PLATO modules. See table 3 for more information on these gains.

Table 3. Intermediate Algebra and Geometry 2 PLATO and non-PLATO gains

Users		**OSAT scores 2000 - gain**
PLATO users Intermediate Algebra	M SD N	5.95 (5.23) 41
Non-PLATO users Intermediate Algebra[5]	M SD N	2.59 (5.83) 190

[5] Non-PLATO users are those learners who did not participate in HILL.

Table 3 (cont'd). Intermediate Algebra and Geometry 2 PLATO and non-PLATO gains

Users		**OSAT scores 2000 - gain**
PLATO users Geometry2	M SD N	6.29 (4.84) 41
Non-PLATO users Geometry2	M SD N	2.55 (5.86) 191
PLATO users Intermediate Algebra/ Geometry2	M SD N	5.58 (4.87) 53
Non-PLATO users Intermediate Algebra/ Geometry2	M SD N	2.52 (5.95) 179

Table 3 (cont'd). Intermediate Algebra and Geometry 2 PLATO and non-PLATO gains

Users		OSAT scores 1998	OSAT scores 2000
PLATO users Intermediate Algebra	M SD N	230.76 (6.83) 41	236.71 (8.88) 41
Non-PLATO users Intermediate Algebra	M SD N	229.32 (10.66) 190	231.91 (11.83) 190
PLATO users Geometry2	M SD N	231.32 (7.31) 41	237.61 (9.12) 41
Non-PLATO users Geometry2	M SD N	229.20 (10.54) 191	231.75 (11.68) 191

Table 3 (cont'd). Intermediate Algebra and Geometry 2 PLATO and non-PLATO gains

Users		OSAT scores 1998	OSAT scores 2000
PLATO users Intermediate Algebra/Geometry2	M SD N	230.28 (7.22) 53	235.87 (9.18) 53
Non-PLATO users Intermediate Algebra/Geometry2	M SD N	229.31 (10.79) 179	231.83 (11.97) 179

T-Tests: Intermediate Algebra and Geometry 2

Paired-sample t-tests revealed that learner OSAT sub-scale scores on the 2000 test increased significantly over the 1998 test for PLATO users and non-PLATO users for Intermediate Algebra, Geometry2 and a combination of these modules, including:

- PLATO users for the Intermediate Algebra modules increased from a mean score of 230.76 to a mean score of 236.71, for a gain score of 5.95 points, t(df 40)= -7.280 p<.000.
- PLATO users for the Geometry2 modules increased from a mean score of 231.32 to a mean score of 237.61, for a gain score of 6.29 points, t(df 40)= -8.318 p<.000.
- PLATO users for the Intermediate Algebra/Geometry2 modules increased from a mean score of 230.28 to a mean score of 235.87, for a gain score of 5.58 points, t(df 52)= -8.357 p<.000.
- Non-PLATO users for the Intermediate Algebra modules increased from a mean score of 229.32 to a mean score of 231.91, for a gain score of 2.59 points, t(df 189)= -6.136 p<.000.

- Non-PLATO users for the Geometry2 modules increased from a mean score of 229.20 to a mean score of 231.75, for a gain score of 2.55 points, t(df 190)= -6.027 p<.000.

For each of the five strands (Calculation/Estimation, Algebraic Relations, Geometry, Measurement, and Statistics), Intermediate Algebra and Geometry2, there were the following significant differences in OSAT post-scores between PLATO and non-PLATO learners, including:

- Algebraic relations; F(21, 209) = 2.085, p<.005
- Geometry; F(25, 207) = 1.535, p<.056
- Measurement; F(23, 153) = 1.690, p<.033
- Statistics; F(36, 194) = 1.912, p<.003
- Intermediate Algebra/Geometry2; F(44, 187) = 1.919, p<.001

Correlations between PLATO Module Mastery and 1999 OSAT Math Scores

Many factors influence the relationship of PLATO usage data and achievement, so correlations of these data with gains are often difficult to interpret. For completeness, however, they are reported here in tables 4 and 5.

Table 4. Correlation with OSAT Scores

PLATO module	N	r
Overall	146	.19*
Geometry	84	.267*
Intermediate Algebra/Geometry2	53	.281*

* Correlation is significant at the 0.05 level (2-tailed).

Table 5. Correlations between PLATO Module Mastery and OSAT gain

PLATO module	N	r
Overall	146	.307**
Geometry	84	.25*
Intermediate Algebra	41	.34*

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Table 6 (next page) displays learner OSAT percentile rankings for math scores for 8th Grade (1998) and 10th Grade (2000). These data are interesting because they demonstrate a difference between PLATO users' 2000 OSAT improvement and the rest of the school's OSAT 2000 improvement. Somewhat masked by the OSAT raw scores and the drop in the 2000 pass rate (with the cutoff score increased to 239), the percentile ranking of the learners assigned to the HILL stayed the same from 41 % in 1998 to 41 % in 1999 t(df145)=-9.125 p<.000 (effect size = .19; average score = 232). Conversely, non-PLATO users and the entire FGHS learner body percentile ranking dropped. Non-PLATO users' percentile ranking dropped from 54% in 1998 to 45% in 2000 t(df84) = -2.434 p<.017; whereas the entire FGHS learner body's percentile ranking dropped from 45% in 1998 to 41% in 2000 t(df(230) = -8.275) p<.000; average score = 232. For more information, see figures 10-11. Essentially, the performance of the learners in the HILL cannot be held responsible for the overall FGHS learner body decline in the 2000 OSAT. This is important because it shows that compared to the rest of the state, the learners assigned to the HILL improved considerably – despite the high fail rate. It also establishes that the OSAT test administered to sophomores in 2000 with a pass score of 239 was relatively more difficult than the 1998 test. Thus, it is important to consider percentiles along with raw scores and pass/fail data in evaluating and planning remediation strategies.

Table 6. OSAT Percentile Rankings for Math Scores for 8th Grade (1998) and 10th Grade (2000)

Users		OSAT scores 1998	OSAT scores 2000
PLATO users	M SD N	41% (7.93) 146	41% (9.36) 146
Non-PLATO users	M SD N	54% (12.64) 85	45% (14.45) 85
Total FGHS learner scores	M SD N	44% (10.09) 231	41% (11.49) 231

Attitudinal/beliefs

Instructor. Table 7 (see Appendix A) displays the responses to the instructor survey completed by Mr. Opperman in July 2001. It includes: Part 1 - instructors' agreement or disagreement with different PLATO features; and Part 2 – instructors' descriptions of how often they perform certain priming and instructional activities in support of PLATO. Mr. Opperman reported that he has used computers (including non-PLATO) in his teaching for eight years. His open-ended responses are reported in Table 8 (in Appendix A).

Learners. Mean score responses to the Likert items in the learner survey are displayed in Table 9 (see Appendix C). These survey items are based on the respondents' agreement or disagreement with different PLATO features (Strongly Agree = 5, Agree = 4, 3 = Neutral, 2 = Disagree, 1 = Strongly Disagree). Part 2 of the learner survey asked learners to describe what they liked and disliked about PLATO and is summarized in

Table 10 (in Appendix C). Figures 13 – 33 include bar charts displaying frequency distribution by response for each item on the learner survey.

Overall, learners' average attitude scores were positive. Learners reported little computer anxiety or difficulty working with computers (see responses to items 1-4). Responses to items addressing self-efficacy (items, 12, 13, 16, and 20) were average. Only one question received an average of less than 3. The question, "the computer makes me nervous" received a 2.08.

Principal. Mr. Robert Schlegel, FGHS principal, was interviewed during late July, 2001. Results of this interview are summarized and analyzed in this section. The interview lasted approximately forty-five minutes. The interview covered a range of topics related to the implementation of PLATO in the HILL program.

FGHS' original purpose of using PLATO was to improve learners' math and language arts scores. Mr. Schlegel is very pleased with PLATO and noted significant scores and overall improvement. The HILL program is fully attended by FGHS learners. Honor learners are the only learners who do not fully participate. Learners "see it as their normal routine. There is no griping about being in the lab" from learners or parents.

Though improving learners' math scores is still the overriding purpose, there is interest in "expanding its [PLATO] use." Mr. Schlegel commented that they are "underutilizing [the] software's capacity." He is interested in knowing more about other software packages, such as reading, history, science, etc. He also expressed an interest in finding out more and possibly using PLATO's Math Problem Solving package.

Some of Mr. Schlegel's positive comments focused on Mr. Dave Opperman's management of the HILL. He commented that Dave has a special combination of interpersonal and technical skills to make HILL a success. He "meets these expectations in spades." He is confident that Dave would do all he could do to accelerate learners' individual learning during HILL. Dave may expand learners' learning profile depending on their math expertise. He is "a master" of organizing HILL activities with instructors and their curriculum. He definitely has credibility with instructors from a variety of disciplines. FGHS instructors are impressed with PLATO because of Dave.

Because of this confidence and enthusiasm about PLATO, there is a new PLATO initiative at FGHS. This school is developing a credit recovery program with several disciplines. During the fall semester, learners who have existing low scores from a previous class, now can redo their grade using PLATO. This will take place during after the regular school hours. There also is interest in implementing PLATO at the middle school.

School officials noticed a gap in math scores for the 5th, 6th and 7th grades. Mr. Schlegel wonders if PLATO can help with these gaps.

Discussion and recommendations

One of the most striking statistics is the gain on the overall OSAT and the five strands for PLATO learners compared to non-PLATO counterparts. In each scenario (i.e., overall OSAT score and the five strands), PLATO learners made considerable gains. This is particularly evident in the higher levels of math (i.e., Geometry, Measurement, Statistics and Geometry2). Despite a higher cutoff score of 239 for the 2000 OSAT exam, HILL learners' percentile ranking remained the same at 41% whereas non-HILL learners and the entire FGHS learner body rankings declined. It is interesting to note that HILL learners, non-HILL learners and entire FGHS learners outperformed the state's passing rate. Only 37% of 10th graders in Oregon high schools passed the 2000 OSAT. Although only 29% of FGHS learners passed the 2000 OSAT[6] and the overall lack of pass rate improvement should remain an issue for the school, it is important to note that the proportion of HILL learners passing the test just about equaled the non-HILL learners, even though the HILL learners represent the bottom two standard deviations of the population. Non-PLATO users most likely did not encounter a ceiling effect[7]. The highest OSAT 2000 score for a non-PLATO user was 267 (99%) and the average passing score for non-PLATO users was 247.88 (82%). For the HILL learners, the highest passing score was 260. The average passing score was 244. The average score for all HILL learners was 232. Obviously, HILL learners have made dramatic strides in their math skills as demonstrated in their OSAT scores. In effect, they "caught up" with their non-HILL peers. Again, no ceiling effect is evident. Quite possibly an extended study of HILL learners' usage of PLATO needs to go beyond this two-year duration.

From the learners' attitude survey, there appears to be overall satisfaction and confidence. Compared to Hannafin and Opperman's 1999 report, there are many similarities in responses. For instance, for the question, "Getting to my lesson is easy", an average response for 2002 respondents was 4.3, whereas the average score for 2001 respondents was 4.64. Average score for 2002 respondents for the question, "My instructor helps me see the connection between what I'm studying on and off the computer," was 4.00; their 2001 counterparts' average score was 3.98. 2002 and 2001 respondents expressed their confidence in doing their schoolwork. The average score for 2002 respondents for the question, "The computer lessons make me feel more confident about doing well in school" was 3.38 and the average score for

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[6] In 2001, 38% of FGHS learners passed the OSAT math test.

[7] A ceiling effect occurs when learners' achievement levels exceed what the test can measure. This can have the effect of depressing measured learning gains erroneously.

2001 respondents was 3.51. One learner writes "I am doing a lot better in Math!!!" There are some concerns about respondents' "boring" statements that voice their displeasure towards PLATO. One respondent suggested making PLATO more interactive. This respondent remarked, "it is not adjusted to the person; it is just one test for everyone."

This voiced suggestion and concerns point to possible avenues of improvement for the HILL program. One cannot expect PLATO to cover all of the state's curriculum standards—it cannot be a "magic bullet" or a "sole solution." Therefore, some additional PLATO and non-PLATO activities may need to be included in the instruction. One possible additional PLATO activity could be the implementation of Problem Solving Activities (PSA's) included in PLATO Math Problem Solving curriculum. PSA's are based upon principles for teaching problem solving.[8] This would add variety and interactivity to the curriculum, and strengthen the curriculum's emphasis on problem-solving. Because of FGHS' enthusiasm for PLATO products, it appears that both Mr. Schlegel and Mr. Opperman would be interested in this additional package.

It might also be possible to use PLATO's diagnostic and practice tests to further individualize the curriculum. However, care must be taken to maintain the strength of the present alignment to state standards, a major advantage of the present program.

Another recommendation is to reinstate FGHS usage of the PLATO language arts curriculum[9]. There is a known correlation between reading ability and math achievement, which has nothing to do with technology. FGHS may consider expanding the HILL to include reading, or at least screening for reading level, is an additional recommendation for improvement. In the future, HILL learners , who read below grade level could first work on improving their reading, then work on their math.

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[8] For more information about these principles, please refer to Foshay, R. and Kirkley, J., *Principles for Teaching Problem Solving.* Technical Paper #4: Edina, MN: TRO Learning, Inc., 1998.

[9] In 2001, PLATO released an entirely new reading curriculum.

Appendix A: Instructor Survey Results

Table 7: Instructor Survey Response by Item

Part I Directions: We would like to know how you felt about your experience teaching with the PLATO® system. For each of the statements below, please **check (✓) the box under:**

SA if you **strongly agree**
A if you **agree**
N if you **neither agree nor disagree**
D if you **disagree**
SD if you **strongly disagree**

	Question	SA	A	N	D	SD
1	The PLATO course content includes what my students need to learn about the topics taught.	❑	X	❑	❑	❑
2	The PLATO course objectives correspond to those for my course.	❑	X	❑	❑	❑
3	The PLATO course content corresponds to the content of the standard end-of-course test we use.	❑	X	❑	❑	❑
4	Content seemed generally free of errors and inaccuracies.	❑	X	❑	❑	❑
5	Content was generally up-to-date.	❑	X	❑	❑	❑
6	Quality and style of instruction was consistent throughout the curriculum.	❑	X	❑	❑	❑
7	Students generally understood the explanations.	❑	X	❑	❑	❑
8	There was adequate depth in exercises and tests.	❑	X	❑	❑	❑
9	Tests, application/drill lessons, and tutorials corresponded to the objectives in the Instructor Guides.	X	❑	❑	❑	❑
10	Tutorials involved the students through frequent questions, answers and feedback, rather than just reading and mouse-clicks to go on.	X	❑	❑	❑	❑
11	Software was generally free of bugs and errors.	❑	X	❑	❑	❑

Question		SA	A	N	D	SD
12	All courseware used consistent keystrokes and display style.	X	❑	❑	❑	❑
13	Color was used appropriately.	❑	X	❑	❑	❑
14	Graphics were used appropriately.	❑	X	❑	❑	❑
15	Screens were consistently readable.	X	❑	❑	❑	❑
16	I was able to use student progress reports to identify students needing my attention.	X	❑	❑	❑	❑
17	I was able to spend time in one-on-one tutoring and counseling while students used PLATO.	X	❑	❑	❑	❑
18	I was able to make appropriate individual student assignments on the system.	X	❑	❑	❑	❑
19	My students were scheduled to use PLATO for as much time as they needed.	❑	❑	X	❑	❑
20	I was able to relate what the students studied on PLATO to what they studied in other activities.	X	❑	❑	❑	❑
21	In general, my students respond well to the PLATO system.	X	❑	❑	❑	❑
22	My students rarely seemed confused or "trapped" by the system.	❑	X	❑	❑	❑
23	My students respond well to the PLATO system.	X	❑	❑	❑	❑
24	I find working with the computer is generally a productive, rather than frustrating, experience.	X	❑	❑	❑	❑
25	I enjoy working with the PLATO computer system.	X	❑	❑	❑	❑
26	The PLATO system plays a useful role in my teaching.	X	❑	❑	❑	❑
27	I was adequately trained to operate the PLATO system.	X	❑	❑	❑	❑
28	I would like more training on how to use PLATO to best advantage in my teaching.	X	❑	❑	❑	❑

Table 7 (cont'd)

Part II Directions:

Please rate how often you performed the following activities in class before your students used PLATO. Circle your responses using the following scale:

5 = Before or after each computer session

4 = Before or after most computer sessions

3 = Occasionally, before or after a new unit or lesson

2 = At the beginning of each semester or marking period

1 = Maybe one time during the year

0 = Never

	Item	Rating
29	Articulated to the student(s) in some way those prerequisite skills, knowledge, or attitudes needed to fully succeed with their newly assigned PLATO modules.	**5** 4 3 2 1 0
30	Helped the students relate what they were about to learn in their PLATO assignments to their own personal previous experiences.	**5** 4 3 2 1 0
31	Described to the students the specific objectives they were going to learn within their assigned PLATO courses or modules.	**5** 4 3 2 1 0
32	Explained to the students how the skills and knowledge learned within their assigned PLATO modules fit into the overall course or lesson goals.	5 **4** 3 2 1 0
33	Clearly identified to the students the rewards and incentives for trying hard and doing well within the PLATO system.	5 **4** 3 2 1 0
34	Explained to the students specific procedures for getting support if they didn't understand something they were trying to learn within the PLATO system.	5 **4** 3 2 1 0

Table 8: Summary of Instructor Open-Ended Survey Responses

Part III Directions: Please write your response to each question in the space provided.

1. What do you like **best** about teaching with the PLATO computer?

Plato allows me to work one on one with students while it provides students with a learning tool that allows them to work at their own level and pace.

2. What do you like **least** about teaching with the PLATO computer?

When I encounter errors in the reporting system.

3. Was there a regular time within the sequence of a lesson or unit in which your students experienced their PLATO modules? For example, did they visit the computer lab during the introduction to a new lesson or unit? Or did they use PLATO during the activity or information phase of a lesson? Or during the practice, review, or transfer (application) phase? Or was PLATO used only as an assessment tool? If yes, briefly explain.

PLATO was offered for 45 minutes every other day to students working to meet state content standards. This was in addition to their regular math class.

4. Describe any strategies you employed to determine whether or not the PLATO modules assigned to each student were the most appropriate for ensuring their success in your class.

Aligned PLATO to state standards, assigned according to previous scores on state tests.

5. How would you change the PLATO lessons?

I would not.

6. What suggestions do you have to improve the way you use the PLATO system?

Require applications and note taking to improve retention.

7. What other comments or suggestions do you have on the PLATO system or this course?

<No answer>

Appendix B: Graphs of OSAT Achievement Data

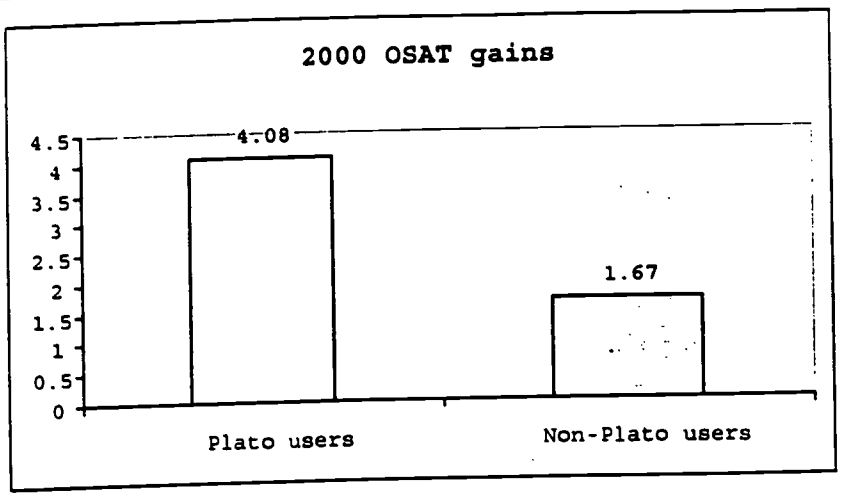


Figure 1

OSAT Gains by Strand

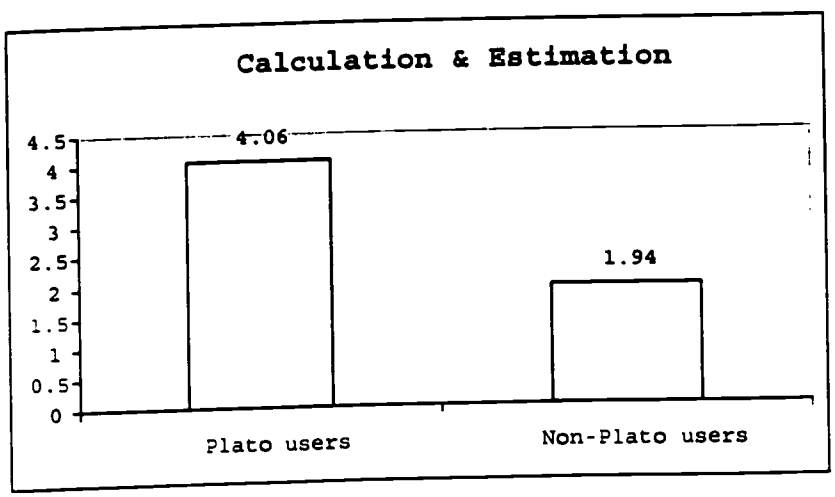


Figure 2

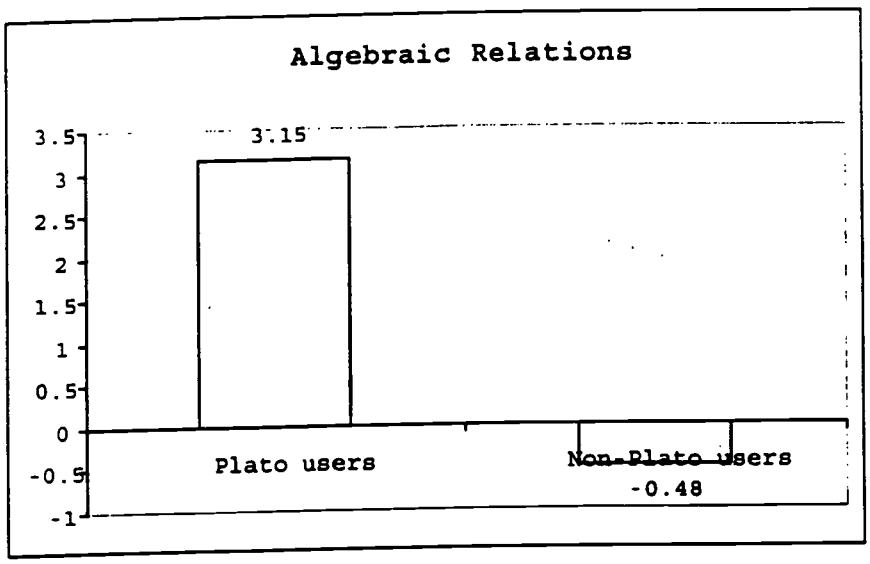


Figure 3

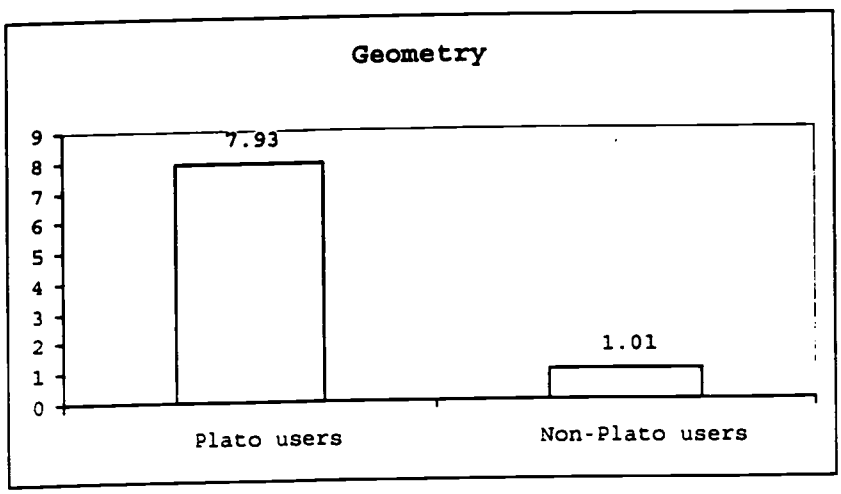


Figure 4

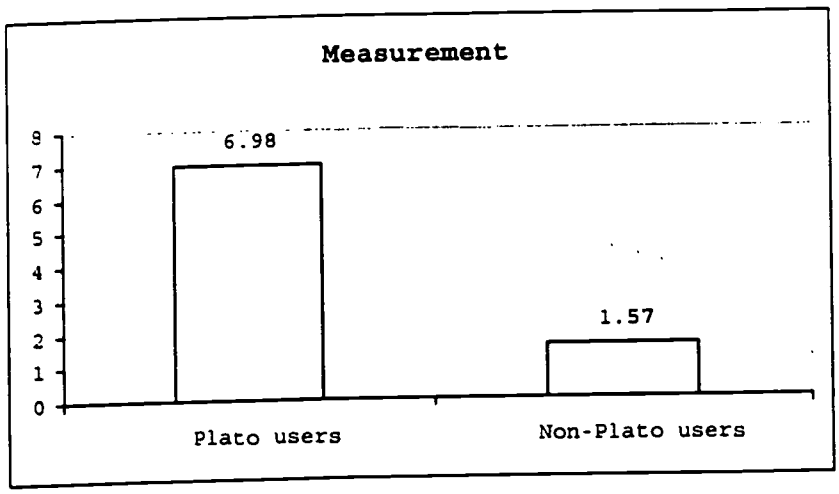


Figure 5

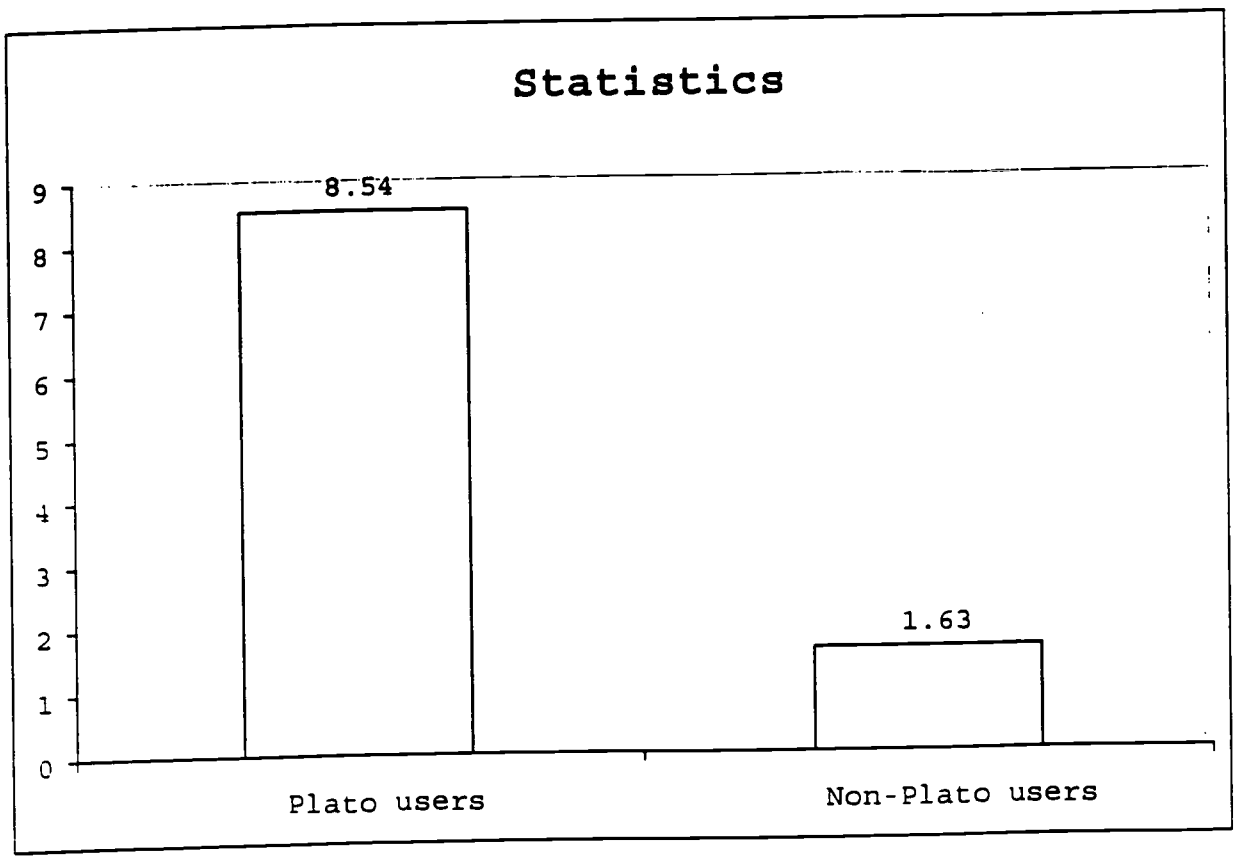


Figure 6

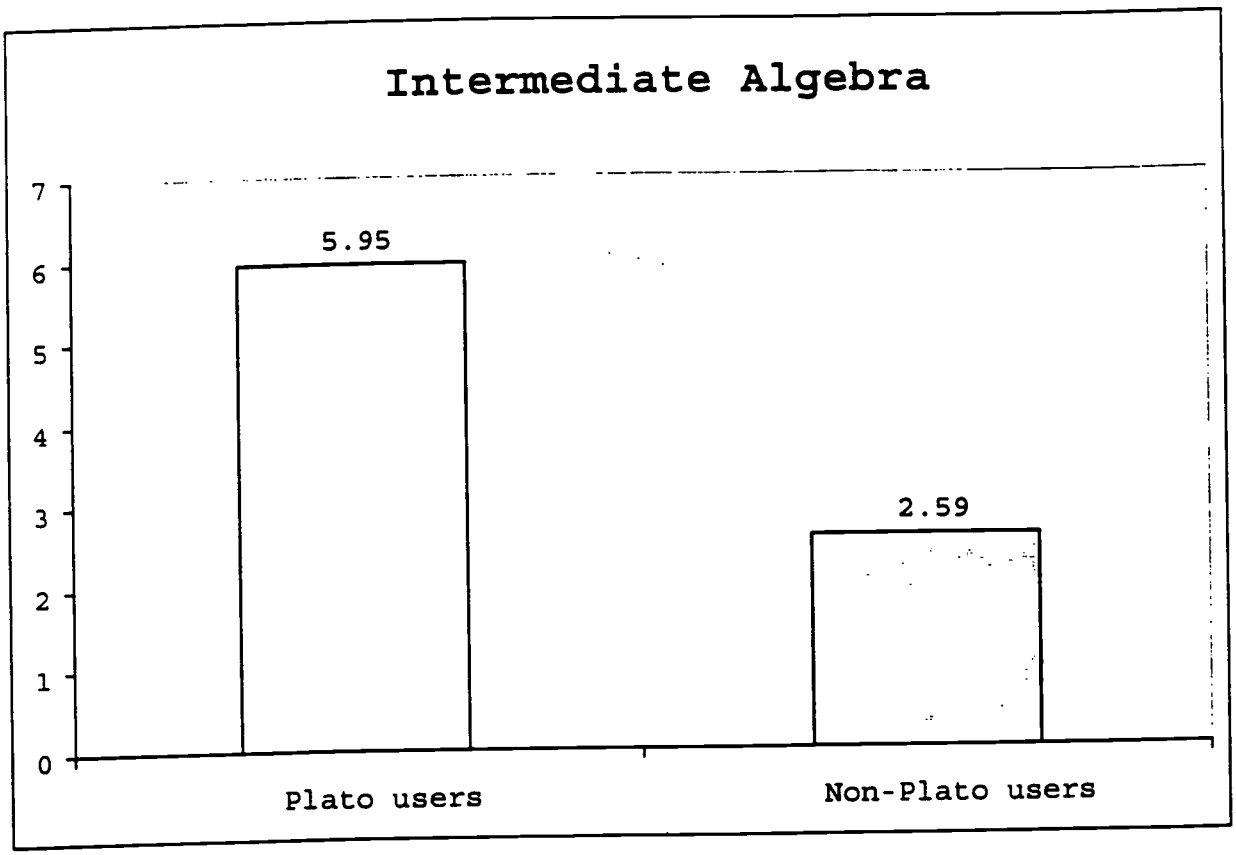


Figure 7

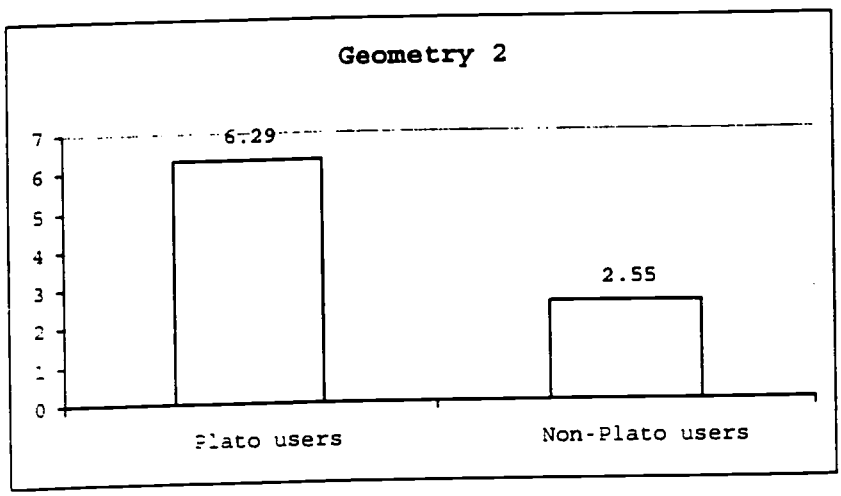


Figure 8

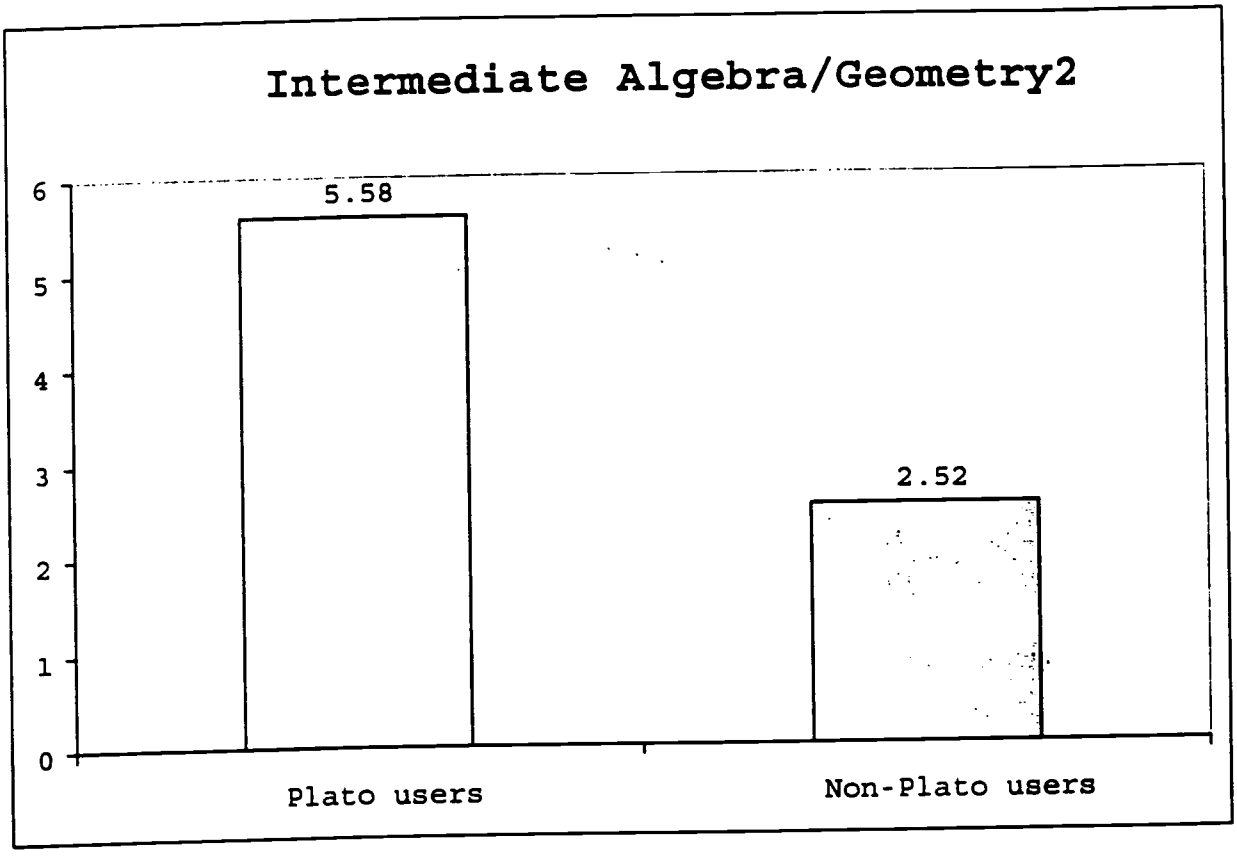

Intermediate Algebra/Geometry2
6
5
4
3
2
1
0
5.58
2.52
Plato users
Non-Plato users

Figure 9

Percentile Rankings

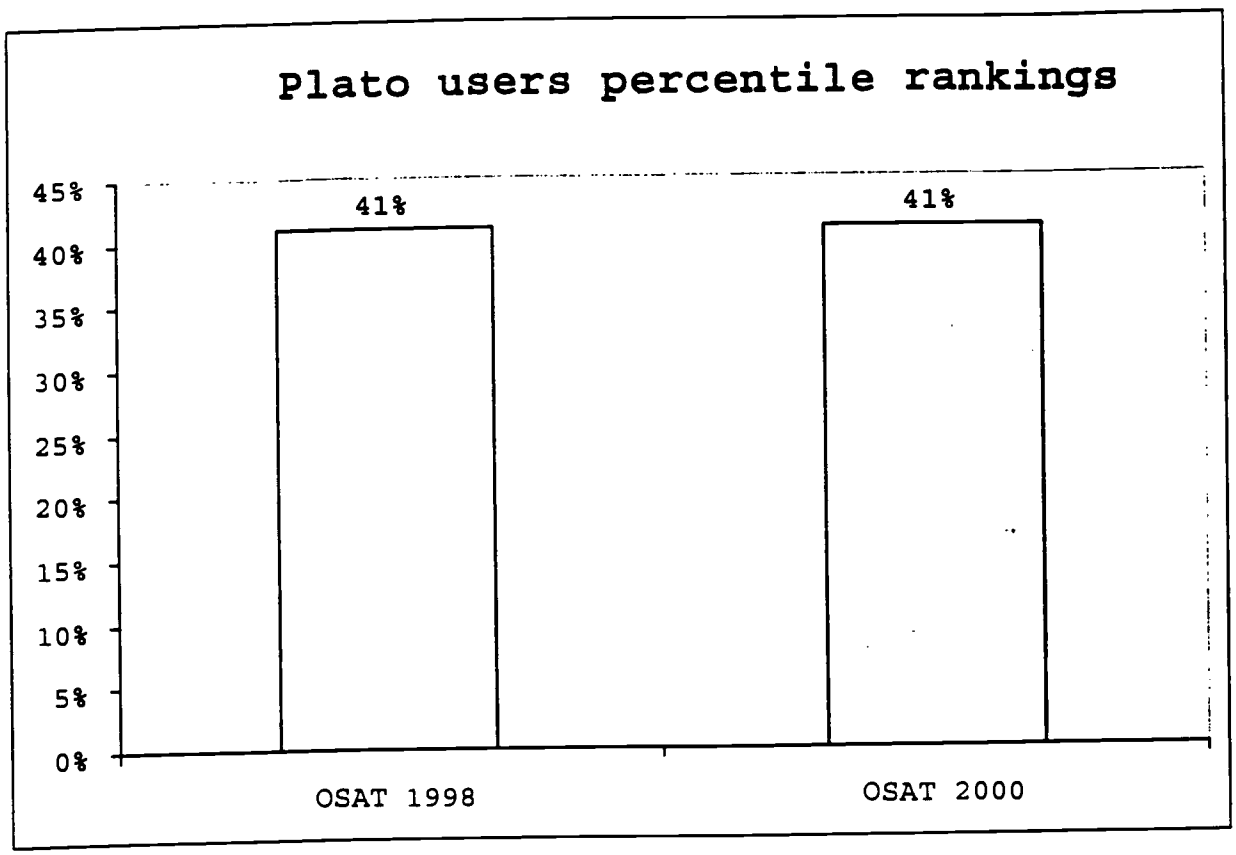


Figure 10

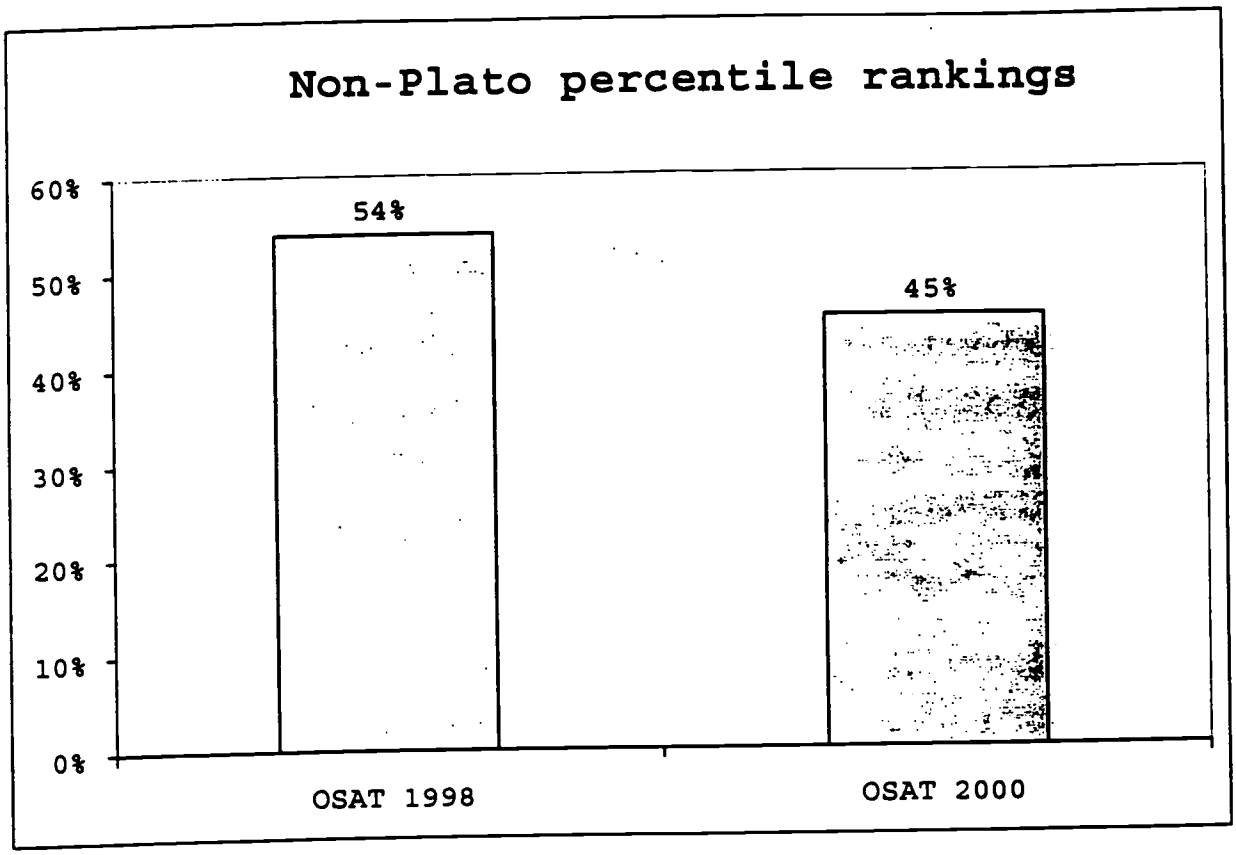

Non-Plato percentile rankings
60%
50%
40%
30%
20%
10%
0%
54%
45%
OSAT 1998
OSAT 2000

Figure 11

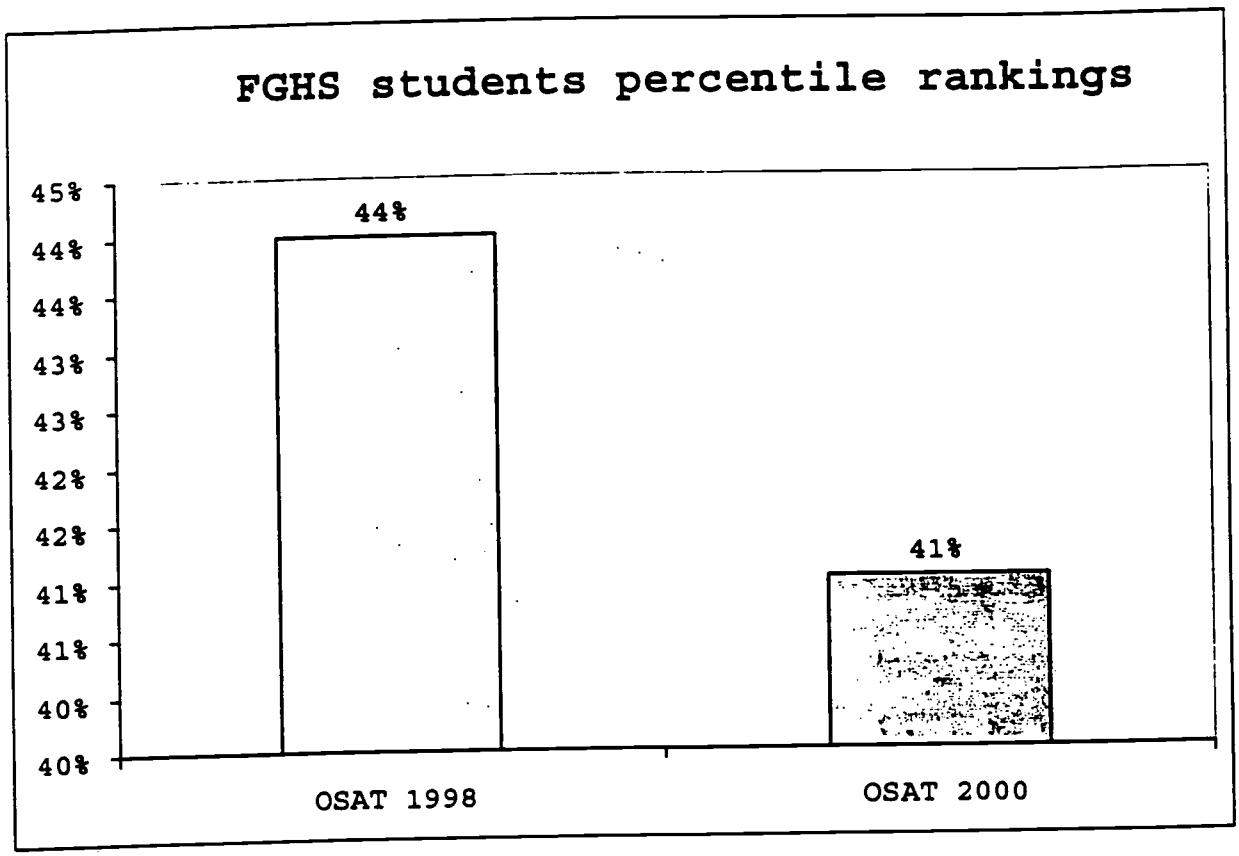

FGHS students percentile rankings
45%
44%
44%
43%
43%
42%
42%
41%
41%
40%
40%
44%
41%
OSAT 1998
OSAT 2000

Figure 12

Appendix C: Learner Survey Results

Question		SA	A	N	D	SD	n	M (SD)
1.	I am able to sign on to the computer without problems.	17	17	2	1	0	37	4.35 (.716)
2.	Getting to my lesson is easy.	14	20	3	0	0	37	4.30 (.618)
3.	The computer is easy to use.	13	19	5	0	0	37	4.22 (.672)
4.	I can start and stop a lesson whenever I want.	19	11	5	1	0	36	4.33 (.828)
5.	The computer lets me do something (like answer questions) often and not mainly just watch.	13	18	3	2	0	36	4.17 (.811)
6.	"I usually can understand what the computer teaches me, without help from my instructor."	6	12	10	8	1	37	3.38 (1.09)
7.	The computer gives me help when I need it.	5	11	15	5	1	37	3.38 (.982)
8.	I can work at my own pace on the computer.	11	23	2	1	0	37	4.19 (.660)
9.	I'm studying the same topics at the same time on and off the computer.	5	12	13	7	0	37	3.41 (.956)
10.	My teacher helps me see the connection between what I'm studying on and off the computer.	14	13	7	2	1	37	4.00 (1.03)

11.	I feel I'm studying what I need to on the computer.	10	15	7	5	0	37	3.81 (.996)
12.	The lessons on the computer are designed for people like me.	6	9	14	4	2	35	3.37 (1.09)
13.	"When I give a wrong answer on the computer, I feel bad about myself."	1	4	14	12	6	37	2.51 (.989)
14.	I would like more time to study on the computer.	5	5	16	7	4	37	3.00 (1.15)
15.	The computer makes me nervous.	1	1	11	11	13	37	2.08 (1.01)
16.	Working on the computer makes me feel good about myself.	3	4	21	6	3	37	2.95 (.97)
17.	I recommend learning from the computer.	5	11	13	4	3	36	3.31 (1.12)
18.	The computer lessons I work with are interesting.	2	13	14	5	3	37	3.16 (1.01)
19.	I try hard to learn from the computer lessons.	5	18	13	2	0	37	3.73 (.732)
20.	The computer lessons make me feel more confident about doing well in school.	4	13	14	5	1	37	3.38 (.953)
21.	Describe how much you think the PLATO computer system has helped you in Math.							3.24 (1.09)

1. What do you like best about learning from the computer?

- Work at my own pace. [12]
- No teachers involved. [4]
- Give us extra help in the tutorial. [2]
- No homework. [2]
- I am doing a lot more better in Math!!! [1]
- What I like best about a computer is that shows you how to do the work. [1]
- The best part is because all the work stays on the computer. [1]
- You don't have to write anything. [1]
- If you fail a test, you can go back to the tutorial and find out how to do the problems you missed. [1]
- You can take the tests more than once if you don't pass the first time. [1]
- I get a star when I complete the unit I'm in. [1]
- It was more hands-on. [1]
- I don't get embarrassed when I get the answer wrong. [1]
- It is easy to cheat. [1]
- I like how I can move from lesson to lesson whenever I want. [1]
- That it explains first what to do before starting and review. [1]

2. What do you like least about learning from the computer?

- It is boring. [9]
- Tutorial. [2]
- That I can't figure anything out. [2]
- Sometimes I don't understand. [2]
- Can't have discussions with an inanimate object. [2]
- The thing where if your variables are in capitals they mark it wrong. [1]
- Sometimes it gets a little confusing. [1]
- On mastery tests, you don't find out what it was that you missed. [1]
- Taking mastery tests over and over. [1]
- Can be doing something more valuable. [1]
- Only when it doesn't work! [1]

- No homework, sometimes I just want homework. [1]
- Sometimes, I don't understand the way they do the problems. [1]
- That we can't go on mastery test whenever we want to. [1]
- It not very easy to go back and do it again. [1]
- I can't ask it questions, such as if I wanted to know more on how the xxx works. I can't ask a computer that. [1]
- Does not always let me know what I did wrong on a missed problem. [1]
- That sometimes you don't even touch the computer and it logs as itself. [1]
- It is not adjusted to the person; it is just one test for everyone. [1]
- Sometimes it won't work I don't understand. [1]
- Makes me feel like a failure when I'm done. [1]
- Too slow. [1]
- It doesn't really help. [1]
- Only one try and test answers and then it goes if xxx start over. [1]

3. How would you change the computer lessons or the way you use them?

- I would not change them at all. [8]
- I would have them be a lot more interesting. [4]
- No tutorial.
- I don't think I can change.
- Not have to do them that much.
- Shorter. Not as much stuff to work on.
- Speaks to you.
- Yes, maybe.
- Make them more for individual people.
- Make it easier to learn the lessons.
- I would make them more fun like and have a student, teacher level.
- Higher math categories.
- Give more helpful help.

4. What other suggestions do you have to improve any part of the course(s) which use PLATO?

- Not have to be on the computers that long. [3]
- Have more teachers in the classroom to help explain the problems and more time to do assignments (like more applications and practice more before the test). [1]
- I think you should have more questions on the tests! [1]
- I have no suggestions, everything is fine. [1]
- Don't make it all gray in the things/mode. [1]
- Even more stuff after finishing. [1]
- Have something to read it for you. [1]
- I don't think it needs improve when we got two very cool teachers in the lab to always help! [1]

Graphs of Learner Survey Data

Note: in these graphs, 1= Strongly Disagree, 2= Disagree, 3= Neither Agree nor Disagree, 4= Agree, 5= Strongly Agree

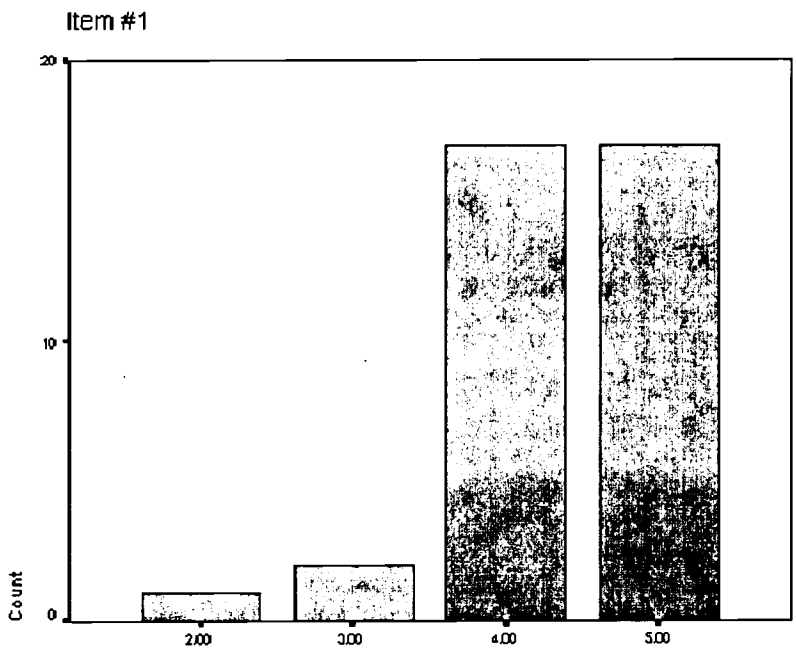


Figure 13

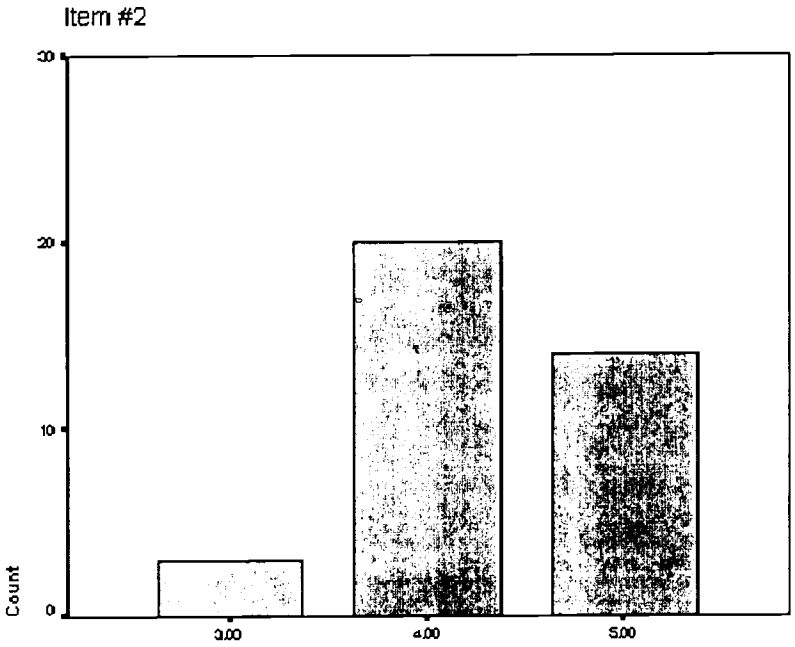


Figure 14

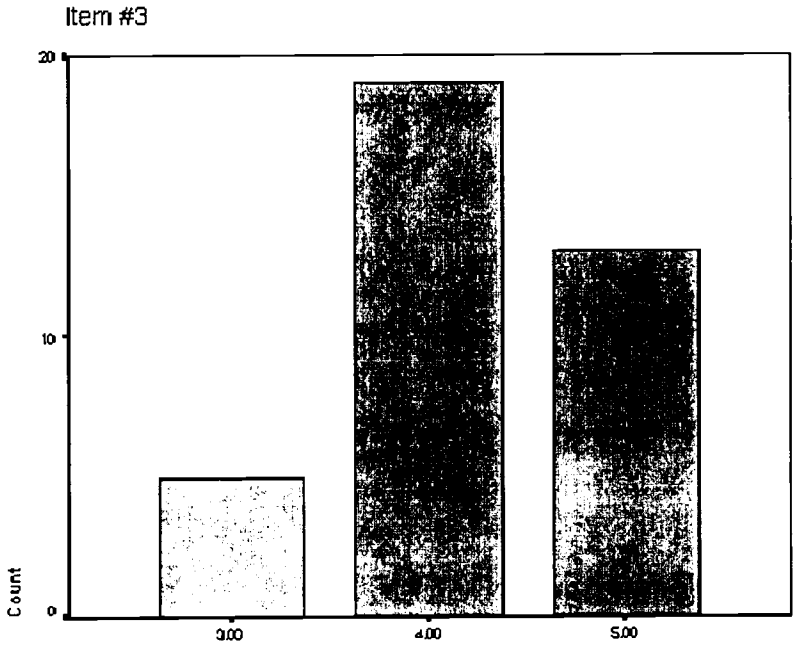


Figure 15

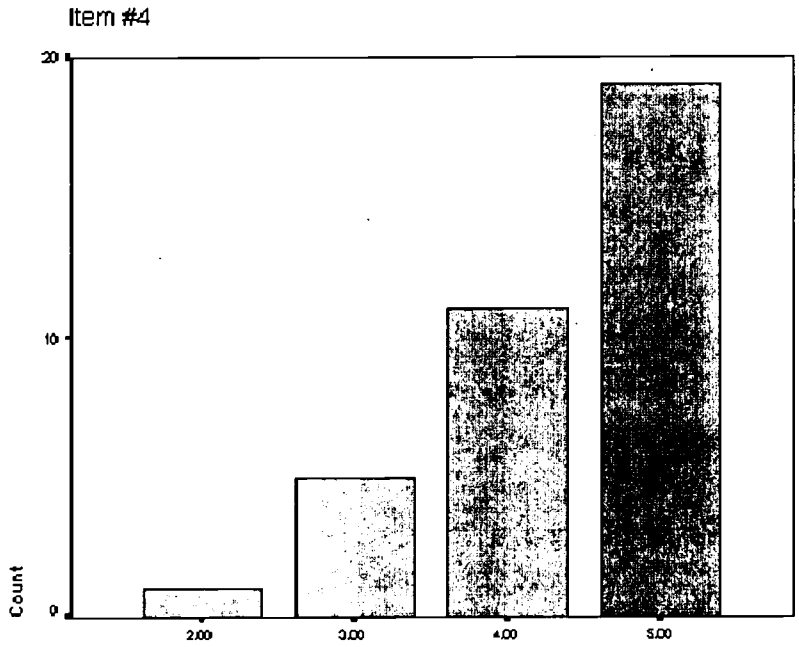


Figure 16

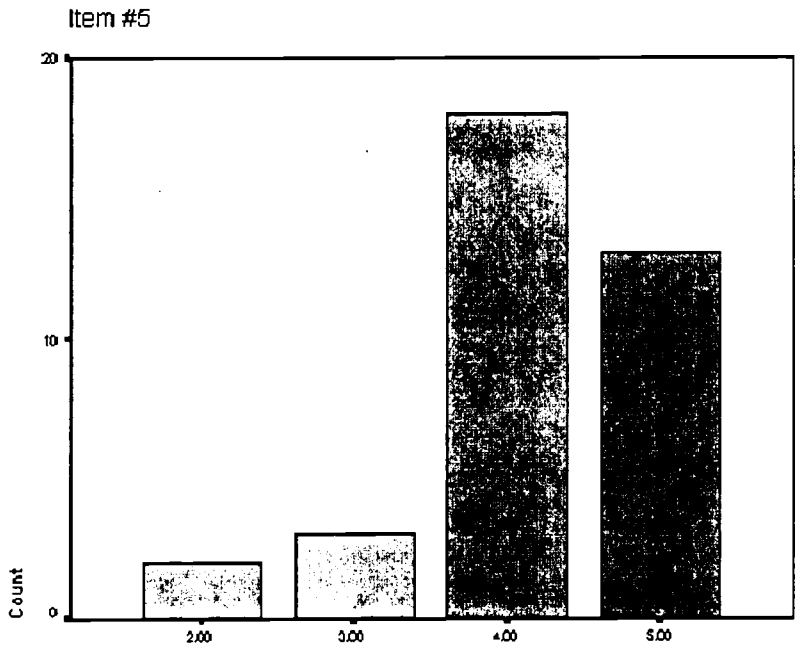


Figure 17

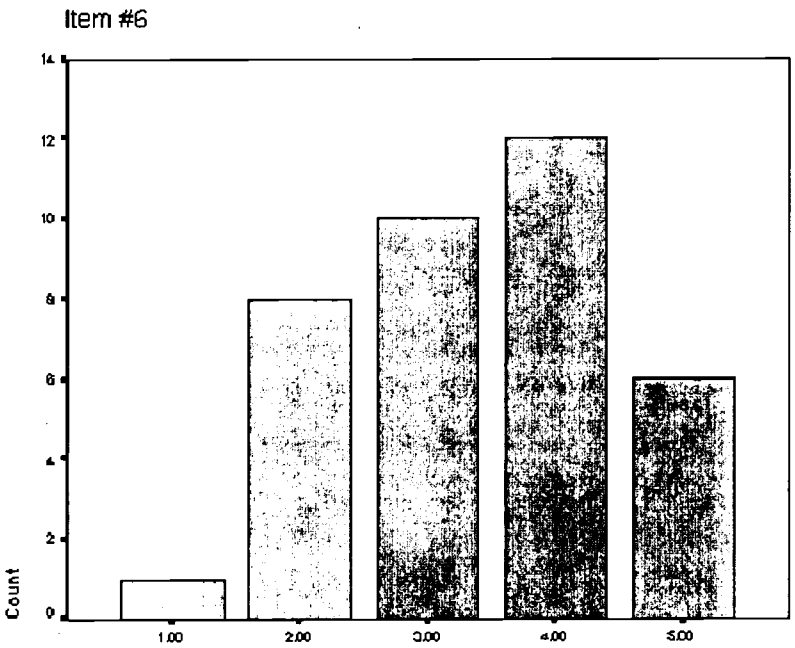


Figure 18

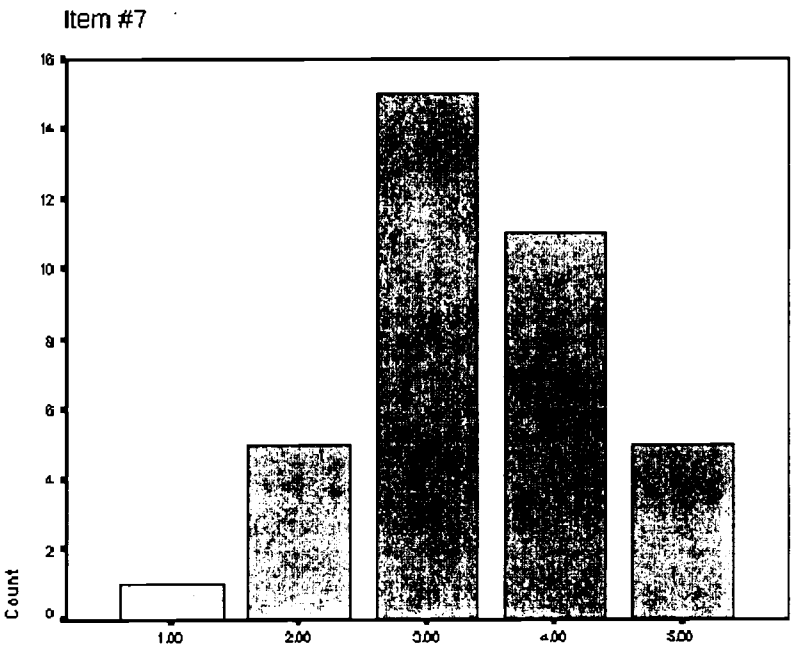


Figure 19

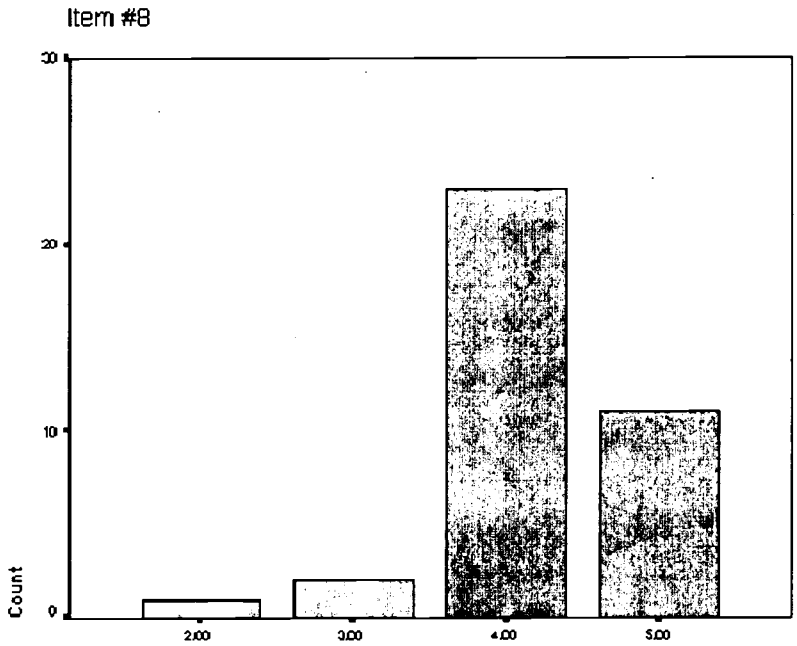
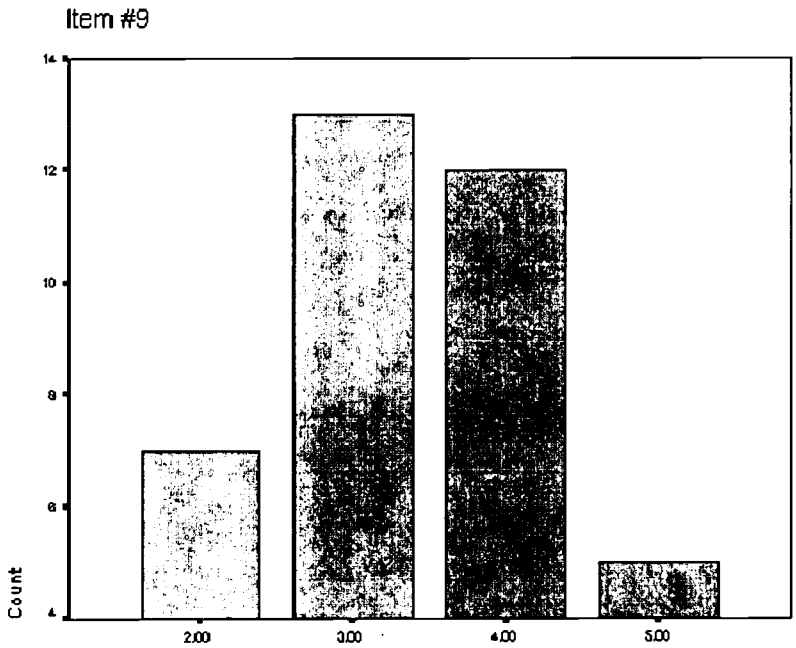


Figure 20



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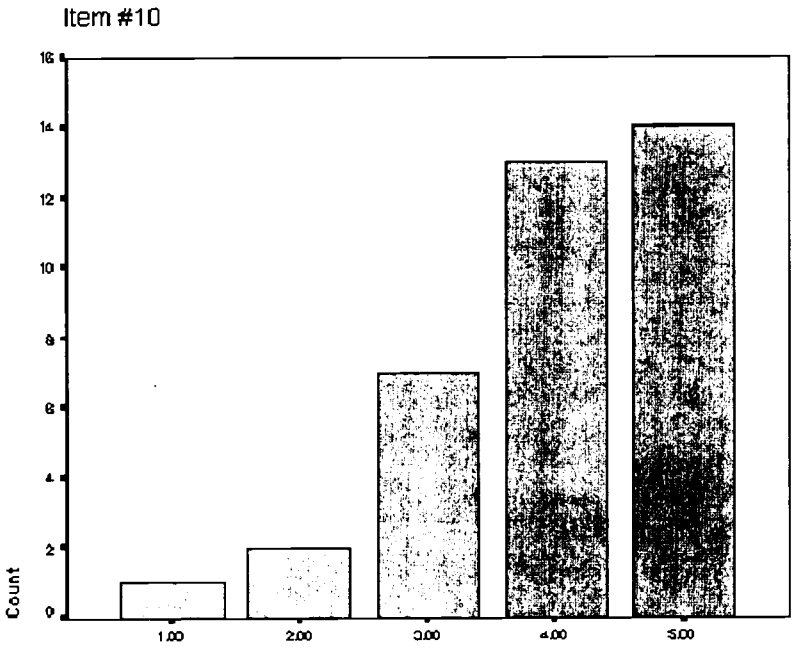

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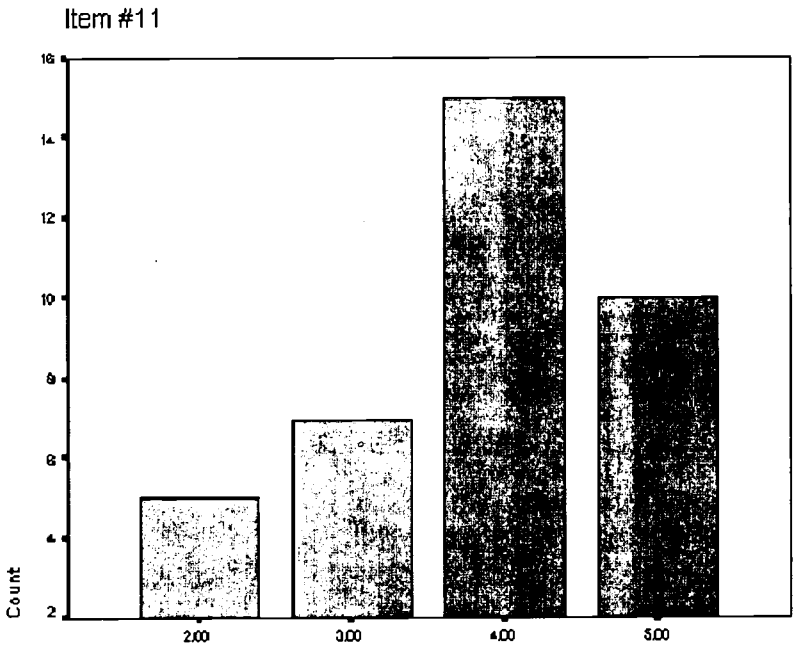

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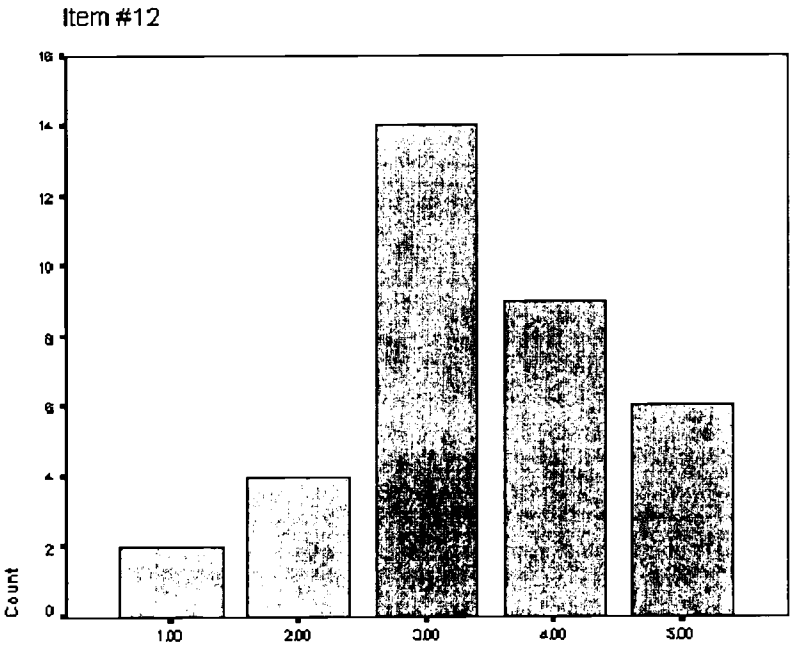

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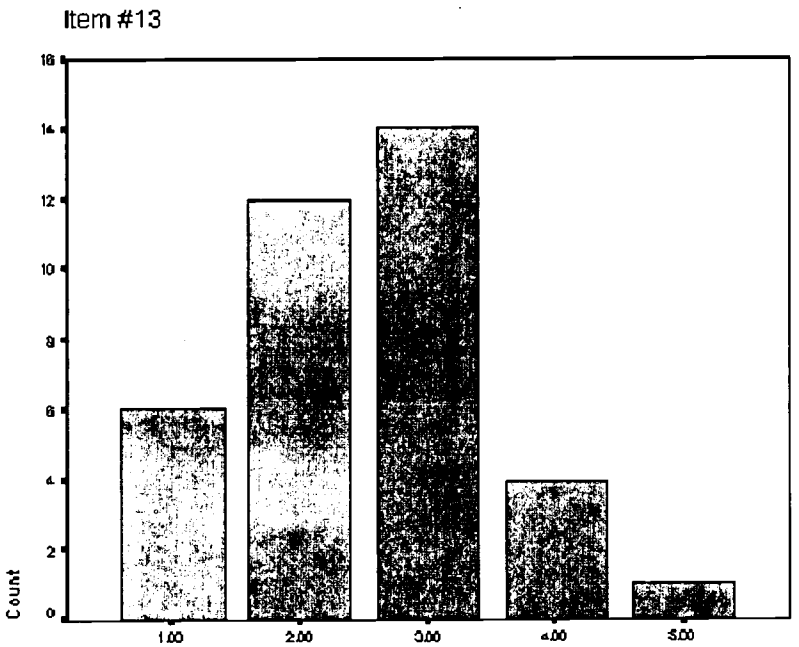


Figure 25

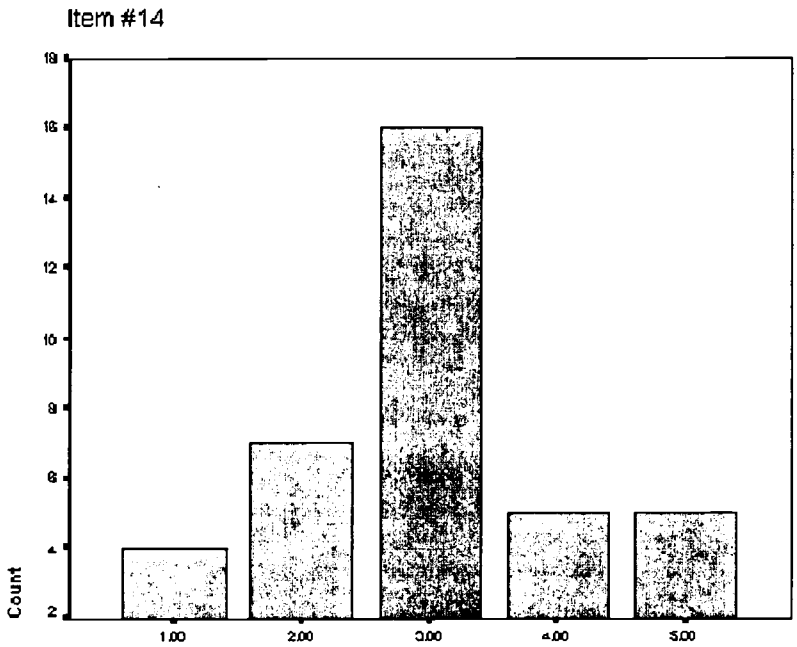
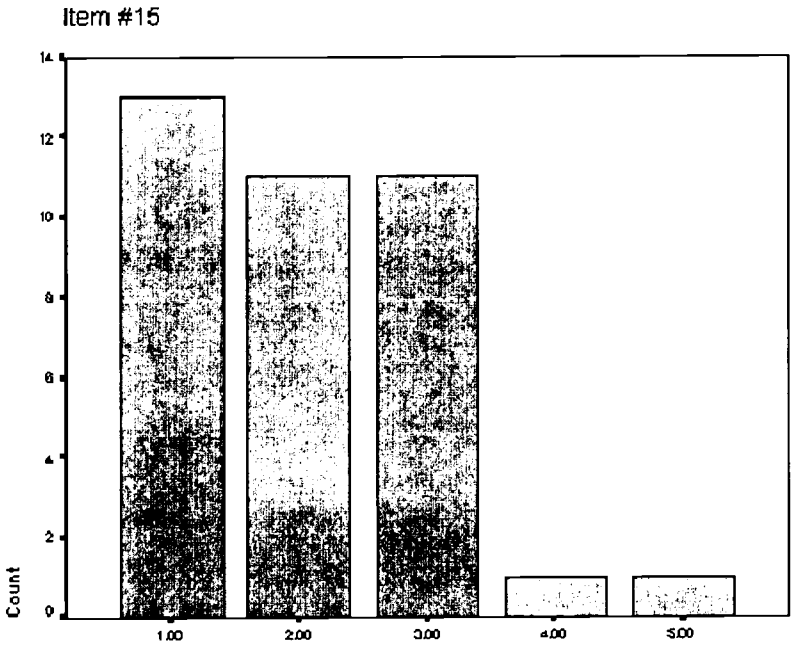


Figure 26



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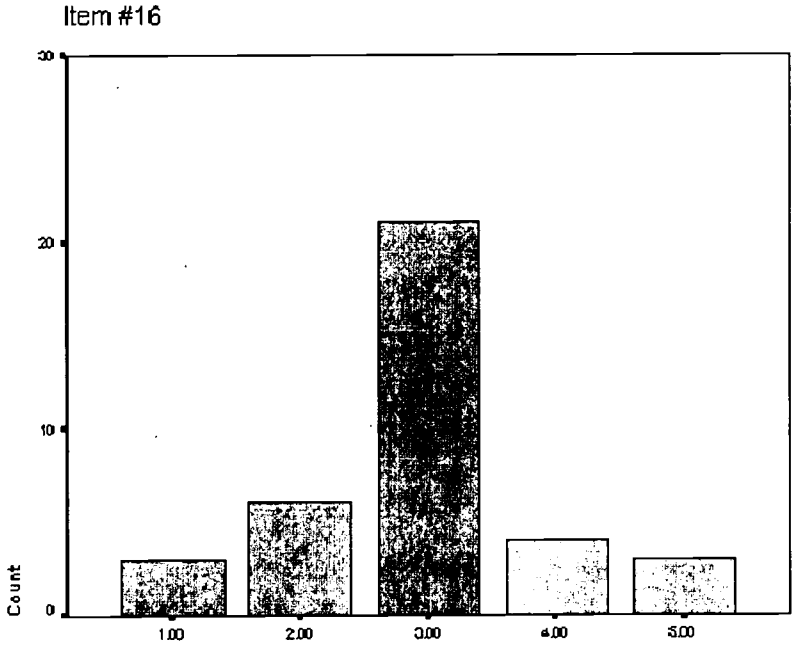

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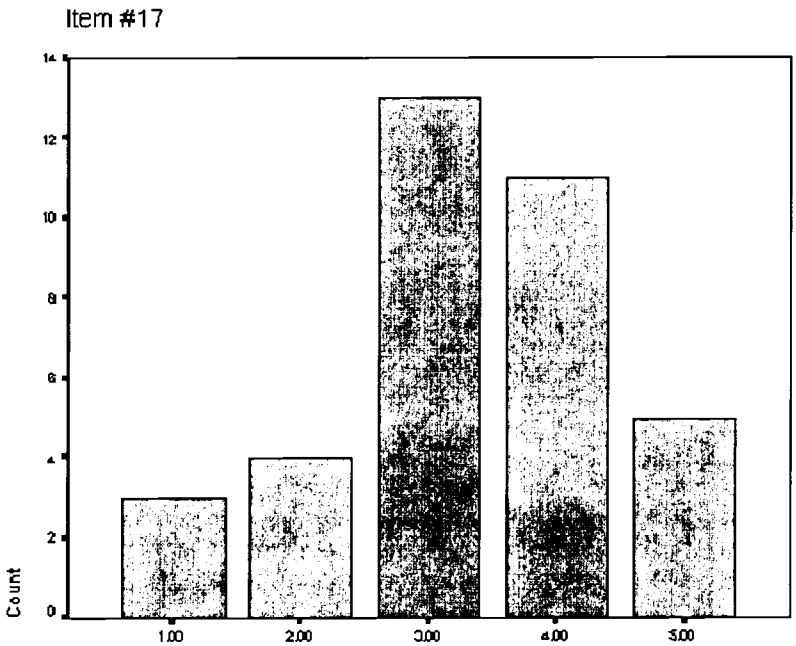

Figure 29

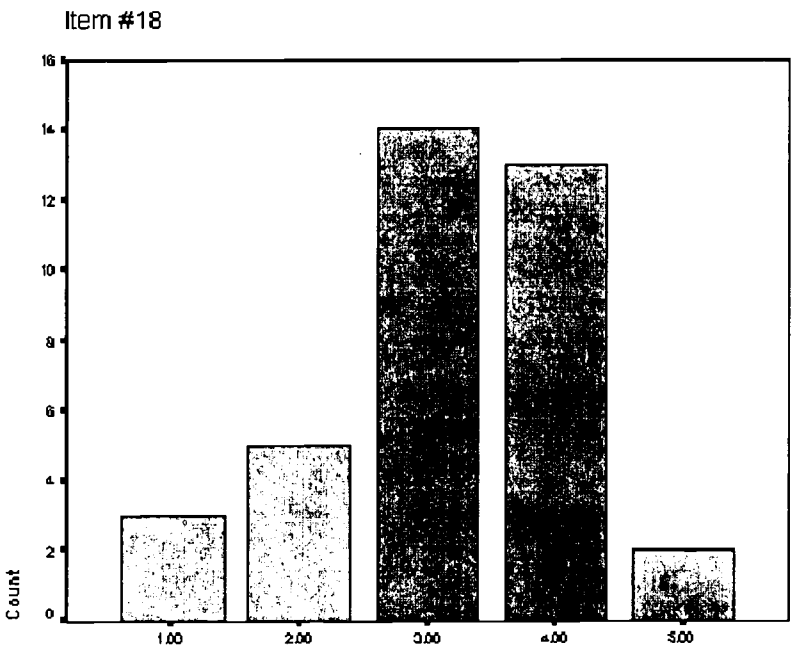

Figure 30

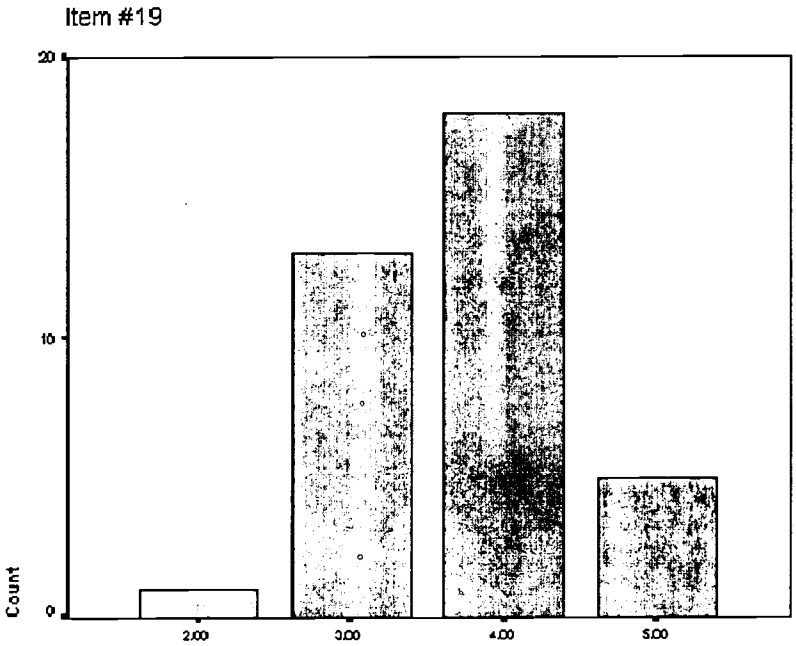

Figure 31

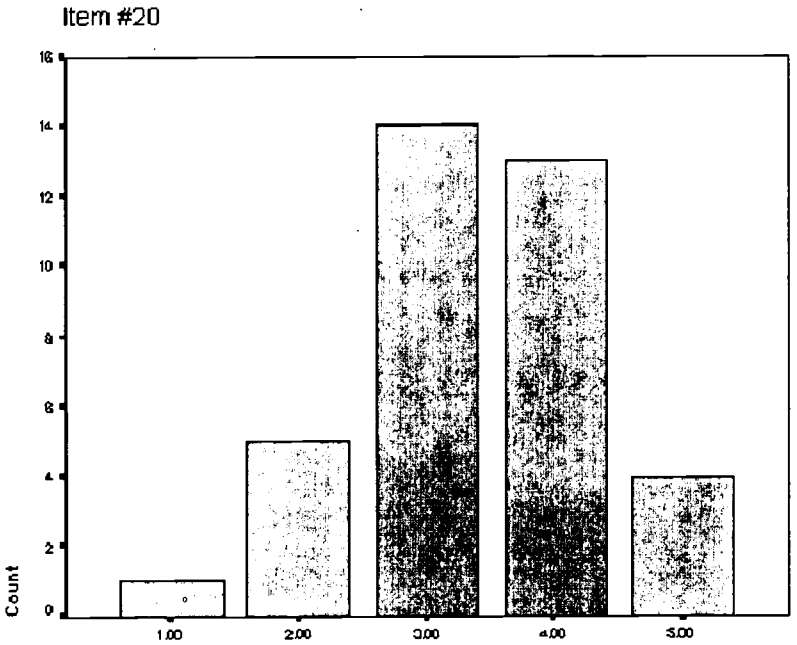

Figure 32

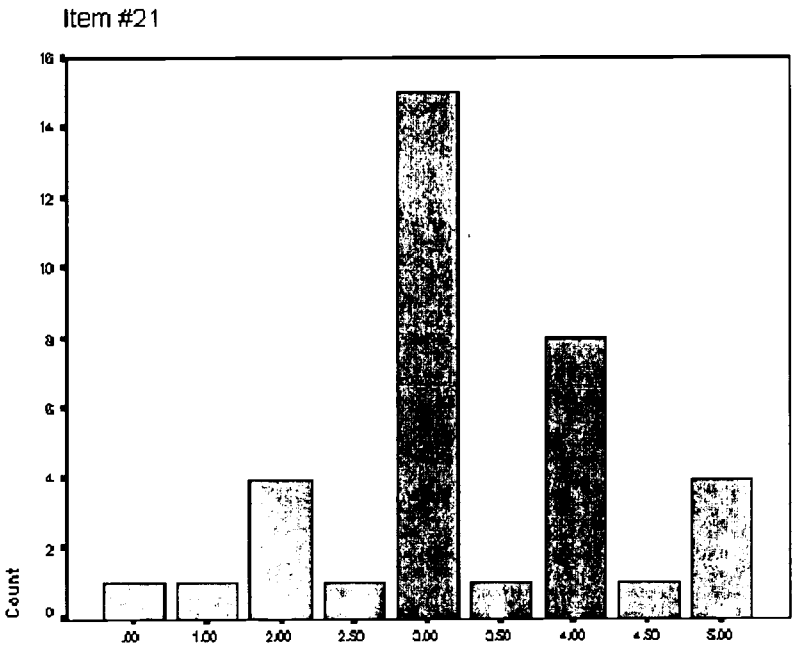

Figure 33

About the Evaluator

William A. Sugar is an assistant professor of Instructional Technology at East Carolina University, where he teaches in an Instructional Technology graduate program. He earned a Ph.D. in Instructional Systems Technology from Indiana University in 1998. His research interest is technology integration models and in-service faculty development. He has published in educational research journals including *Journal of Research on Computing in Education.* Sugar serves as a board member of *Journal of Computing in Teacher Education.* He has served as a consultant for several public school systems in North Carolina.

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