ANALYTICAL REPORT

ENTRY-LEVEL JOB COMPETENCIES

FOR

AMERICAN SOCIETY FOR MEDICAL TECHNOL

SUBMITTED BY

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ORIGINAL

This report presents statistical analyses of the data set from the "Entry-Level Job Competencies" project jointly sponsored by CLMA, ASCP, and ASMT. ASMT commissioned this report to obtain a comprehensive review of the data. These analyses identified important causal relationships among key variables and raised issues that may be important to ASMT. After a profile of respondents, the report covers several concerns about the data before presenting results raised. The analyses follow with remarks based on the findings contained in Section III.

RESPONDENT PROFILE

Of the 2687 observations in the data set, 62% (1665) were members of ASCP while 14% (367) and 24% (655) were from ASMT and CLMA, respectively. Approximately, 49% of the respondents listed their position as laboratory supervisor, 24% other, and 27% manager or director. Among ASCP members, 65% were supervisors while 53% and 69% of ASMT and CLMA, respectively, were managers or directors. Respondents were either generalists/other (48%) or specialists in some field of clinical practice (52%). ASCP members were more likely to be specialists (67%) while ASMT and CLMA were generalists/other 79% and 82%, respectively. ASMT and CLMA members were more likely to have advanced degrees (masters) than ASCP members; nearly 95% of all respondents had four year degrees or higher.

Respondents averaged 10.6 years of laboratory management or supervisory experience (ASCP averaged 9) and had tenure of 7.5 years in their current position. The largest group of respondents were from hospitals (69%) and independent laboratories (13%). ASCP members were more likely to represent hospitals (72%) than the other groups. Approximately 50% of the respondents had hired a new graduate between 1990-1993. Nearly 33% have not made a hire or have only hired from educational programs associated with their laboratory. The remaining 17% made hires but these hires were 1989 or earlier.

SECTION I. SURVEY DESIGN, STRATEGY, AND DATA BASE ISSUES

In preparing the data set for analysis, several problems emerged that are noted here because they potentially influence the results generated by the statistical procedures.

1. *Condition of the Data Set.* Frequencies of all data elements uncovered several variables with out-of-range values. For example, the scale for importance ran from "1 to 4;" yet values of "0" or "5" were found. Most of these errors occurred in Section III of the survey. The out-of-range value could represent a mis-entered data point for one element or an entire line of incorrectly entered data for one observation. Other data entries included mis-specified lines; in other words the computer was expecting 60 pieces of information and could find only 57. These errors could not be corrected without the actual surveys to key in the correct values or properly adjust the lines of data. Before final analyses are prepared, this data set needs to be thoroughly cleaned and verified.

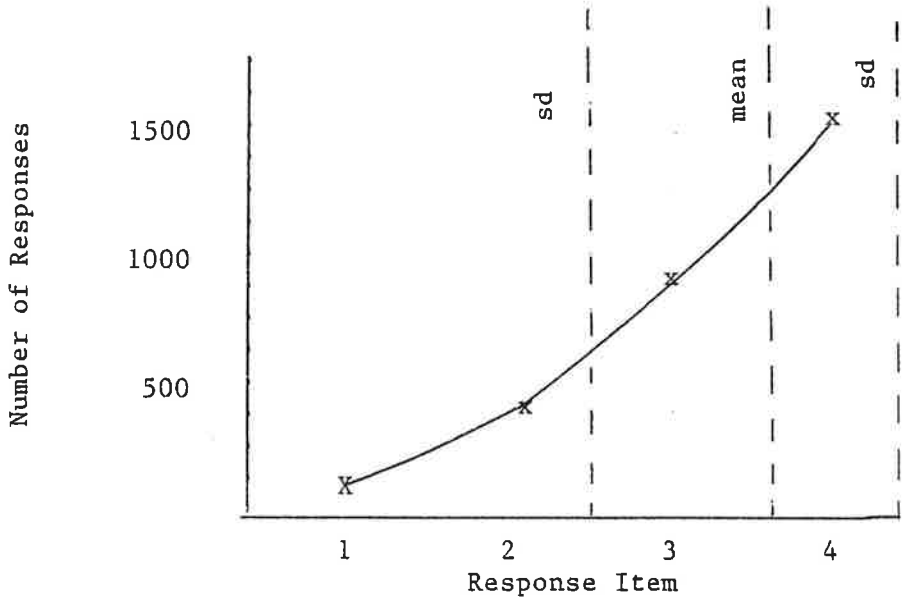
2. *Weighted Sample.* Statistical procedures called for weighting the response by organizational membership. Weighting procedures are used in situations where you know the characteristics of the population before hand and want to insure that segments of the population are properly represented. Organizational membership may be a population descriptor to base a weighting scheme. However, in this case, this approach would not be desirable as the organizations are not mutually exclusive: an individual can belong to more than one group (the president of ASMT does according to the signature block). That means these groups share common characteristics making it difficult to segment and weight for data collection and statistical analysis. The preferred approach would be to use membership as an independent variable; looking for its effect after controlling for all other independent variables that share characteristics (i.e. age, gender, years in position, position title, etc.). If membership appears significant, group affiliation could be identified as contributing to the difference in perceptions on competencies. Weighting, however, reduces the usefulness of this data set by restricting the availability of valid observations.

3. *Scales.* The literature on measurement wavers on the appropriate length of scales. Four point scales are appropriate in bi-polar measurements where the mid-point is not necessary. However, in a unidirectional or Likert scale at least 5 intervals (or 7) are needed. An even numbered, less than five scale plays havoc with variance: values tend to cluster (can't spread) or the mean can misrepresent the true distribution.

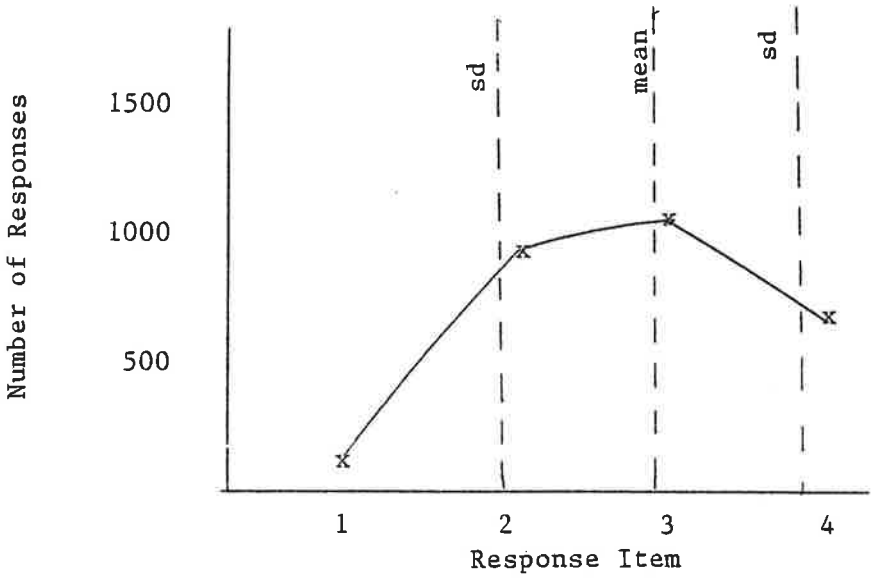
   There was surprisingly very little variance among this scale data. The following distribution of an importance rating shows how the responses are so bunched that one standard deviation around the mean captures nearly all the responses. The response pattern for the corresponding competency rating offered a better distribution.

Figure A. Examples of Rating Response Distributions

Importance of Collecting Samples



Competency of Collecting Samples



The scale length may explain the apparent lack of variance. Another explanation may be that there was not much variance. In other words, laboratory managers and supervisors all agreed on the level of importance of 54 separate duties and also agreed on the level of competencies. If true, this suggests that the "entire profession" believes what job duties are important for new graduates and that all new graduates are not capable of handling these job duties. Regardless of the possible reason, there should have been a wider distribution of the 2,700 responses across the scales.

4. *Survey Construction.* Several additional problems with survey construction were noted that could influence the interpretation of results. Several of the job duties were actually two duties rolled into one statement. For example, "seek assistance/clarification when needed; accept constructive criticism," are related; yet are distinctively different skills. The concern pertains to what part of the statement the respondent's rating referred: the rating may be a "3" with seek assistance being a "2" and "accepting criticism" a "4."

   Demographic characteristics were poorly defined. For instance, more than 20% marked their current position "laboratory other" and 17% denoted "other" as their current area of responsibility. Percentages were even higher for the different organizations, i.e. 28% of ASCP were listed as "laboratory other." The other category should not be large (about 5%). At these levels, a specific subgroup has been misdefined. It may also mean that the wrong people may be filling out the surveys.

5. *Biases.* Several potential sources of bias were identified. Missing values are usually assumed to be random and present few problems in the analysis. However, missing information is widespread with the percentage reaching 10% for some items. Missing data appeared extensively throughout Section III with more than 14% of ASAP respondents not reporting data, 11% for ASMT, and 8% for CLMA. In certain analyses with multiple independent variables or covariants, more than half the survey population is eliminated because of missing data.

   Recall bias may also be present. In the response to the question "In what year did your lab last hire a newly graduated MT not associated with any program in which your lab participated?" 33% failed to respond indicating either they had not hired anyone or all their new hires came strictly through their educational programs. Another 17% indicated that their last hire was between 1980 and 1989. Even though the rating question was hypothetical ("Assume that your lab has just hired a new graduate"), there has to be a frame of reference to draw upon in making these ratings. Approximately 50% of the respondents are possibly basing their ratings on characteristics unassociated with "newly graduated MTs." If significant differences exist on this variable, only those making hires since 1990 should be used.

6. *Statistically Significant Versus Meaningful Results.* With the large number of observations, the statistical power of the data is large. This means that significant differences will appear between groups on rating scales even though the differences in the means are very small. These differences, however, may not be meaningful. Significant results can be used to discern patterns or profiles of different types of raters. Policy and program initiatives, however, may not be served well by significant results; decision-makers need to be mindful of what is meaningful.

With these caveats in place, data were analyzed in a series of steps beginning with item analysis and continuing with grouping techniques (factor analysis). Comparisons were made using specific cohorts (position, area of responsibility, etc.) which were drawn from the demographic data.

SECTION II. ANALYSES

Job Duties. Respondents rated "how important is it that a newly graduated MT be able" to perform 54 separate job related responsibilities. These duties have been sorted from most important to least (means) and grouped approximately to quartile segments, as shown in Table 1. Twenty duties appeared to be very important for new technicians to be able to perform. Seventeen listed duties were rated low, indicating that these duties were not typically assigned to new graduates. In the middle were 10 fairly important and 7 somewhat important duties.

The important duties cluster around three principal themes: work behaviors (ethical, adaptable, initiative), technical skills (measurement, lab procedures), and decision-making (communication, interpretation, judgement). Among these clusters, emphasis was decidedly toward behaviors or personal characteristics. Nearly all of the low rated job duties encompassed management related responsibilities.

Table 1. Job Duties, Importance and Competencies: Comparison of Mean Differences (Means).

	Skill Importance	Competency Likely	Difference	Group Mean Difference
		Very Important Skills		
Group 1: (mean > 3.51)				
Exhibit ethical behavior	3.95	3.38	.57	
Seek asst/accept criticism	3.88	3.10	.78	
Recognize abnormal results	3.86	2.95	.91	
Service to patients	3.81	3.04	.77	
Adhere to laws	3.79	2.95	.84	
Initiative/cooperation	3.77	2.90	.87	
Provide back-up assistance	3.76	2.88	.88	
Confirm abnormal results	3.76	3.06	.70	
Recognize priorities	3.72	2.61	1.09	
Adaptable (changes)	3.70	3.05	.65	
Good judgement	3.67	2.64	1.03	
Measurement protocols	3.67	2.58	1.09	
Recognize equip. malfunctions	3.66	2.54	1.12	
Communicate effectively	3.66	2.74	.92	
Communicate test results	3.65	2.99	.66	
Laboratory procedures	3.59	2.89	.70	
Environmental understanding	3.59	2.91	.68	
Pre-analytic specimen handling	3.58	3.01	.57	
Analyze/interpret data	3.53	2.41	1.12	
Career development	3.53	2.71	.82	
				.84

	Skill Importance	Competency Likely	Difference	Group Mean Difference
Group 2: (mean 3.01-3.50)		Fairly Important Skills		
Evaluate/solve problems	3.50	2.54	.96	
Verify quality procedures	3.50	2.73	.77	
Take corrective action	3.50	2.53	.97	
Collect specimens	3.43	2.82	.61	
Team/lab coordination	3.34	2.72	.62	
Perform preventive maint.	3.33	2.58	.75	
Innovation/creativity	3.24	2.49	.75	
Computer skills	3.21	2.53	.68	
Answer inquiries/questions	3.09	2.24	.85	
Manage stress/conflicts	3.09	2.15	.94	
				.79
Group 3: (mean 2.51-3.00)		Somewhat Important Skills		
Maintain inventory	3.00	2.46	.54	
Explain rational lab tests	2.95	2.38	.57	
Resolve data problems	2.94	2.15	.79	
Integrate/relate data	2.84	2.27	.57	
Volunteer for projects	2.73	2.47	.26	
Quality improvement activities	2.61	1.95	.66	
Assume team leadership	2.61	2.16	.45	
				.55
Group 4: (mean < 2.5)		Not - Somewhat Important Skills		
Instruct students	2.40	2.10	.30	
Compare new techniques	2.31	1.88	.43	
Deliver in-service ed	2.29	1.99	.30	
Direct technicians	2.28	1.81	.47	
Implement new techniques	2.25	1.83	.42	
Participate productivity studies	2.22	1.91	.31	
Write procedures/policies	2.04	1.64	.40	
Write/revise technical prog.	1.99	1.60	.39	
Personnel problem solving	1.87	1.52	.35	
Write job descriptions	1.84	1.56	.28	
Plan/implement instruction	1.84	1.62	.22	
Prepare/conduct meetings	1.81	1.59	.22	
Evaluate new tech. (50)	1.79	1.46	.33	
Evaluate new tech. (21)	1.79	1.43	.36	
Calculate costs/fiscal	1.73	1.45	.28	
Determine work schedules	1.70	1.47	.23	
Manage budget	1.50	1.26	.24	
				.32

Respondents were next asked to rate each job duty according to "how likely is it that a newly graduated MT will be able" to perform this responsibility. The competency ratings are also found in Table 1. The competency ratings are clearly below the importance rating for every job duty. The highest rated competency was ethical behavior and that rating was only equivalent to "fairly likely" to be able to perform. Competency ratings correlated to importance ratings in that, as importance decreased, so did competency. Thus, new graduates were least competent in those duties that were unimportant to their position.

Comparisons between the two scales (paired t-tests) indicated that for each duty the ratings were significantly different. This comparison alone does not mean much; it simply indicates that in no area did competencies approach the level of importance placed on the respective job duties. Scale differences are also provided in Table 1. The magnitude in the difference decreases as importance decreases. A composite average for each group's scale differences revealed for fairly to very important groups the difference approached 1 (.84 and .79, for Groups I and II, respectively). Even though the competencies were rated higher in these groups, competencies fell noticeably short of the importance placed on performing these duties.

Job Duty Groups. Fifty-four items were too many to perform casual analyses on rating variance. To reduce the number of variables, commonalities were found using factor analysis (varimax rotation). Six factors emerged after some subjective sorting as prescribed by Rummel. Factor loading patterns are available from the author; latent factors and their variables are provided in Table 2. The six job functions have been identified as: (1) leadership/management; (2) work environment/behavior; (3) analytical data analysis; (4) problem solving; (5) problem sensing; and (6) data collection. These six functions captured 56% of the item variance. Cronbach's alpha, a measure of how well items grouped together as a function, ranged from .61 to .95; thus, each function represents a valid dimension of work responsibility.

Table 2. Major Job Functions, Derived from Factor Analysis of Importance Ratings of 54 Job Duties.

	Job Function	Variables
1.	Leadership/Management:	Quality improvement (15), compare new techniques (19), implement new techniques (20), evaluate new techniques (21), write technical procedures (22), assume team leadership (38), write procedures/policies (40), write job descriptions (41), determine work schedules (42), productivity studies (43), conduct meetings (44), direct work of technicians (45), personnel problem solving (46), maintain inventory (47), fiscal management (48), manage budget (49), evaluate new technology (50), develop in-service education (52), instruct students (53), and plan/implement instructional unit (54). Cronbach's alpha = .95.
2.	Work Behavior/Work Environment:	Role of lab (30), patient service (31), good judgement (32), initiative/cooperation (33), willing to provide back-up (34), recognize priorities (35), volunteer (36), and team member (37). Cronbach's alpha = .79.
3.	Analytical Data Analysis:	Perform laboratory procedures (4), recognize factors affecting measurement (5), analyze data (6), communicate test results (8), answer inquiries (9), use computers/manage data (10), integrate/relate data (11), confirm abnormal results (12), and verify quality procedures (13). Cronbach's alpha = .80.
4.	Problem Solving:	Resolve problem lab data (14), preventive maintenance (16), equipment malfunctions (17), take corrective action (18), and innovation/creativity (28). Cronbach's alpha = .72.
5.	Problem Sensing/Personal Development:	Recognize results (7), seek assistance (23), take responsibility for career development (24), communicate effectively (25), adhere to laws (26), and ethical behavior (27). Cronbach's alpha = .61.
6.	Data Collection:	Collect specimens (1), perform pre-analytic handling (2), and evaluate problems related to data collection (3), Cronbach's alpha = .68.

Numbers in ( ) refer to item number on the survey; i.e. quality improvement is listed as job duty number 15 on the survey.

Descriptive statistics for the six major job functions are presented in Table 3. For these raters, the most important set of job duties was "problem sensing." The lowest rated duties were found in the group "Leadership/Management." Receiving such a low score might suggest that these twenty tasks should not be included in entry-level job profiles. However, this factor explained the most variance in the item ratings which indicated that raters varied widely on their perceptions of the importance of these duties. From the range of scores (min, max) and variance, a cluster of raters felt these duties to not be important at all (means around 1.49) while another cluster believed them to be fairly important (mean around 3.09). Further analysis will explore which cohort characteristics may be influencing the variation.

The remaining four functions coalesce with means between 3.34 and 3.55 or between fairly and very important. For most of these factors, the variances were small. Take "Data Collection" for example, raters differed at most by .16 on their ratings -- nearly everyone rated these duties exactly the same. The "Work Behavior/Environment" factor produced a wider mix of responses (variance .134) with more disagreement among raters.

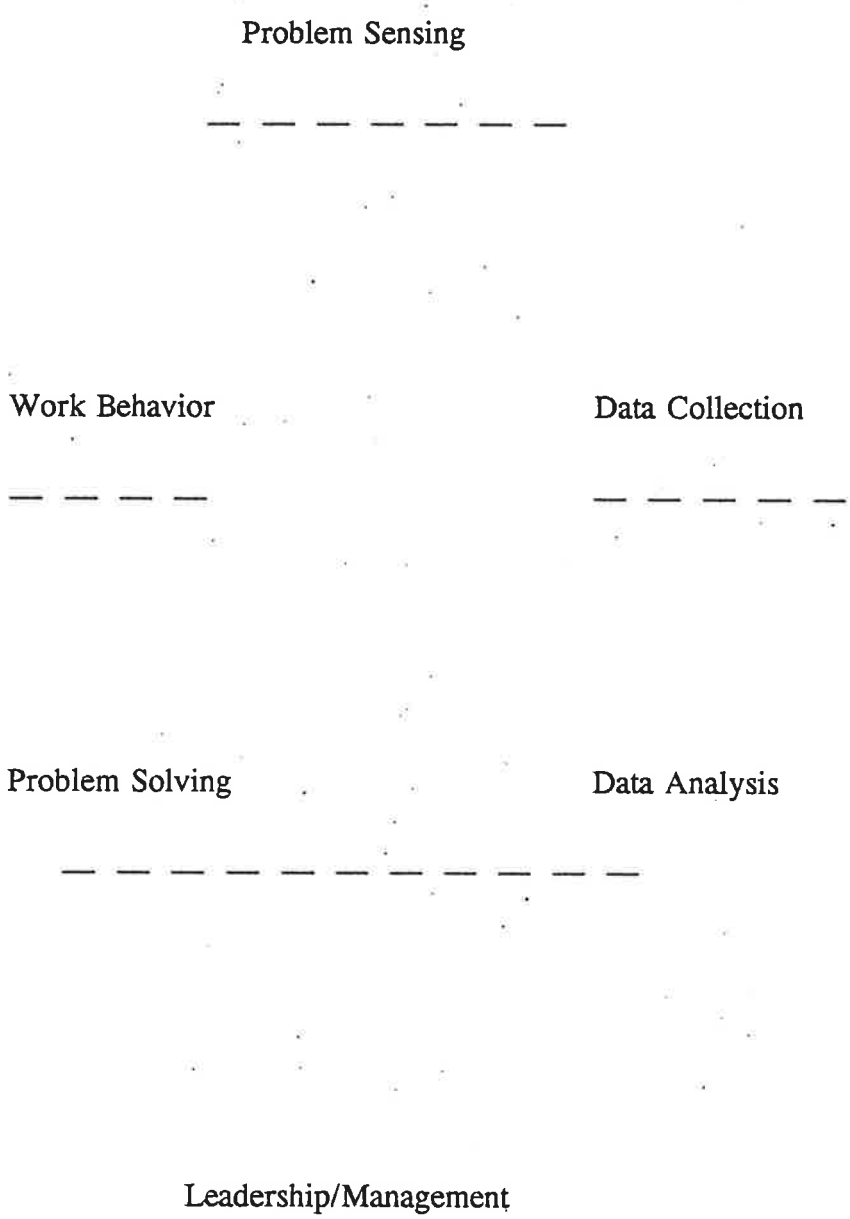
A hierarchy of job duties emerged from the analysis. Figure B represents this potential hierarchy. The top tiers in importance consist of technical and non-technical job duties with the primary focus on non-technical duties/skills.

Table 3. Descriptive Statistics for Job Duty Factors

A. Importance Factor Ratings	Mean	Min	Max	Variance
Leadership/Mgt.	2.09	1.49	3.09	.151
Work Behavior/Envt.	3.55	2.72	3.81	.134
Data Analysis	3.43	2.82	3.76	.096
Problem Solving	3.34	2.94	3.66	.073
Problem Sensing	3.78	3.53	3.95	.024
Data Collection	3.50	3.43	3.59	.006

B. Competency Factor Ratings	Mean	Min	Max	Variance	Mean Diff A-B
Leadership/Management	1.73	1.25	2.44	.088	.36
Work Behavior/Envt.	2.77	2.47	3.04	.036	.78
Data Analysis	2.63	2.24	3.06	.092	.80
Problem Solving	2.46	2.15	2.59	.031	.88
Problem Sensing	2.97	2.71	3.38	.060	.81
Data Collection	2.79	2.55	3.01	.053	.71

Figure B. Hierarchical Representation of Job Duties Based on Mean Scores



The descriptive statistics for the competency ratings are also included in Table 3. Competencies were grouped in a similar manner as importance and reliability tests (Cronbach's alpha) revealed strong internal cohesiveness of these scales: Leadership/Management (.93); Work Behavior/Environment (.87); Data Analysis (.87); Problem Solving (.81); Problem Sensing (.78); and Data Collection (.79). The means ranged from 1.73 to 2.97. Unlike the importance variances, the competency variance are much more limited -- all within .03 to .09 in range.

Aside from Leadership/Management where the ratings were, as expected, very low, the lowest rated competencies were for "Problem Solving" duties. Raters were very consistent in their ratings (narrow range and small variance) on this function. New hires demonstrated their best competencies in "Problem Sensing" duties. In those duties deemed to be most important, newly graduated were fairly capable of performing them. The remaining three functions clustered just below being "fairly capable." In other words, laboratory managers believed that new technicians were likely to be somewhat to fairly competent across the 34 non-management job duties.

The gap between the importance and competency means does provide some indication as to the degree to which competencies fall short of their importance. Again, ignoring "Leadership/Management" duties, there appeared to be a consistent difference of about .8 between the two measures. "Problem Solving," the lowest rated competency duties, earned the widest difference nearly .9. Even though "Problem Sensing" received the highest competency ratings, the gap between importance and competency was over .8. Regardless of the way that the data were analyzed, laboratory managers did not perceive new graduates as being fully competent on numerous basic job duties typically assigned.

Cohort Comparisons. In preparing for the comparison tests (ANOVA, MANOVA, and regression), appropriate descriptors needed to be specified from the demographic information section of the survey. For the analysis of variance procedures, five cohort variables were selected: they are defined in Table 4. For the regression analyses, additional variables were included. Region and state were not considered in any of these analyses.

Table 4. Definitions of Variables Used in Statistical Analyses for MANOVA, ANOVA and Regression

Variable	Analysis of Variance		Regression
POSIT:	1	Director	1 = Director, Manager
(Position)	2	Manager	0 = Supervisor, Other
	3	Supervisor	
	4	Other	
RESPON:	0	Specialist	0 = Specialist
(Area of Responsibility)	1	Generalist	1 = Generalist, Other
	2	Other	
GROUP:	1	ASCP	1 = ASCP
	2	ASMT	2 = ASMT, CLMA
	3	CLMA	
HOSP:	1	Hosp	0 = Other
	2	Independent Lab	1 = Hosp
	3	Other	
LASTHIRE:	0	Missing, No Hire	0 = Missing, No Hire
	1	< 1985	1 = < 1985
	2	1986-1989	2 = 1986-1989
	3	1990-1993	3 - 1990-1993
Supervisory Experience			Years
Current Position			Years

The first step was to compare how groups rated all the six job duty importance functions. In other words, the MANOVA test will show whether weightings across all six functions were the same. Without holding any characteristics as covariants, each of the five variables produced significant results (as shown in Table 5). Using covariants (four variables entered first, capturing their variance), the results changed, especially for GROUP. RESPON, HOSP, and LASTHR account for much of the variance in the data set. They also remain significant after the other variables have been entered in the ANOVA. Alone, GROUP produced significant results; however, group membership did not affect the ratings after controlling for other rater characteristics.

ANOVA's examined individual factors for differences among cohorts. Table 5 identifies significant findings (.01 level) for ANOVA's with covariants specified. Cohort means for each job factor are found in Appendix A. Group membership was important on Leadership/Management and Work Behavior. RESPON produced significance on three importance ratings: Leadership/Management, Data Analysis, and Data Collection. The remaining significant result was for LASTHR on the Data Analysis Function.

One way analysis targeted specific differences and are denoted in Appendix A.[1] ASCP members rated three functions different than ASMT and CLMA members: Work Behavior (less important), Problem Solving (less important), and Data Collection (less important). ASMT members viewed Leadership/Management duties as slightly more important. POSITION and RESPONSIBILITY produced several important comparisons. First, managers rated three factors (Leadership/Management, Work Behavior, and Data Analysis) more important than did supervisors and those classified as "other positions." Second, generalists rated four job functions (Leadership/Management, Data Analysis, Problem Solving, and Data Collection) higher than did respondents who considered themselves specialists. On one function, Leadership/Management, HOSP revealed that respondents from government facilities and medical schools rated this function higher than hospitals or independent laboratories.

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[1]The scale values have not been weighted according to the number of items on the scale. This was done to increase the amount of variance in the scale.

Table 5. MANOVA (Wilkes) and ANOVA Results from Cohort Comparisons (with and without covariants)

	GROUP	POSIT	RESPON	HOSP	LASTHR
Importance					
A. MANOVA					
1. Alone	F=2.02, .019	F=1.92, .011	F=2.72, .001	F=2.55, .002	F=1.92, .011
2. Covariants	F=1.08, .38	F=1.50, .08	F=2.82, .001	F=2.49, .003	F=2.10, .004
B. ANOVA (with covariants)					
1. Leadership/Mgt	.001	x	.01	x	x
2. Work Behavior	.003	x	x	x	x
3. Data Analysis	x	x	.01	x	.01
4. Problem Solving	x	x	x	x	x
5. Problem Sensing	x	x	x	x	x
6. Data Collection	x	x	.004	x	x
Competency					
A. MANOVA					
1. Alone	F=4.33, .000	F=3.06, .000	F=5.05, .000	F=3.27, .000	F=2.50, .000
2. Covariants	F=1.45, .134	F=1.79, .021	F=3.40, .000	F=2.20, .001	F=2.23, .002
B. ANOVA (with covariants)					
1. Leadership/Mgt	x	x	.001	x	x
2. Work Behavior	x	.05	x	x	x
3. Data Analysis	x	x	.000	x	.028
4. Problem Solving	x	x	.010	x	x
5. Problem Sensing	x	x	x	.025	x
6. Data Collection	x	x	x	x	x

Similar tests were conducted for the competency ratings. Results can be found in Table 5 and Appendix A. When covariants were considered, all cohort descriptors, except GROUP, produced significant MANOVA's at the .02 level or less. ANOVA's revealed that RESPON had three significant differences (.01 level) on Leadership/Management, Data Analysis, and Problem Solving. HOSP, LASTHR, and POSIT each had one factor where significant differences appeared; but the significance was higher than found for RESPON, ranging from .025 to .05.

In comparing group means (one way analysis), respondents from ASCP and those who were specialists rated competencies lower, particularly Data Analysis, Problem Solving, and Data Collection skills. ASMT respondents and generalists rated management competencies higher. Respondents from government facilities and academic institutions (medical schools) consistently rated competencies higher than hospital or independent laboratory respondents.

The magnitude of the differences that produce these significant results in both scales were small, often between .5 and .9. Thus, dramatic rating variations were not present. These results suggested that several key demographic factors influenced a person's perceptions of new graduates entering the labor force. Perceptual differences centered around responsibilities (whether one's a generalist or a specialist) and level in organization (manager vs supervisor). Group membership appeared to have a small residual affect: in-other-words, ASCP members viewed new hires differently than ASMT or CLMA, beyond what was explained by other characteristics. These causal relationships will be

examined more closely through regression analysis to determine the primary factors influencing the ratings.

Before leaving this section on mean comparisons, brief mention is made of comparisons between the difference scores (importance - competency). In the MANOVA's with covariants, HOSP and POSIT were significant ($F=2.49$, .003 and $F=1.73$, .028, respectively). The ANOVA's revealed six significant findings: POSIT (Work Behavior and Problem Sensing), RESPON (Data Analysis), HOSP (Leadership/Management and Problem Solving), and LASTHR (Data Analysis). From the one way comparisons, managers stood out in that they tended to have wider scale differences than people in other positions. Respondents from hospitals were likely to have smaller differences than those from private laboratories or government facilities (complete set of results for these analyses available from the author).

Causal Relationships. Regression analyses were employed to determine the strength of the causal relationships between the independent cohort descriptors and the dependent ratings for job duty importance and competency. In order to use the independent variables properly, several coding adjustments were made to construct dichotomous variables (Table 4). Stepwise procedures were used, with an entry requirement of $\leq .05$ and the results are presented in Table 6.

With so little variance to explain, it is interesting to discern a consistency throughout both sets of regression. RESPON and years in the profession contributed in eight of the twelve cases. The signs of the beta coefficients indicate that as years in the profession increased (or years in one's position) importance ratings increased; similarly, competency ratings in Leadership/Management and Problem Solving increased with years. Generalists rated nearly every factor, except Work Behavior and Problem Sensing, higher than specialists. POSIT appeared twice with managers/directors rating Work Behavior more important than supervisors; yet supervisors rated these competencies higher. LASTHR appeared significant for Data Analysis with those hiring more recently placing more importance on these job duties.

By filtering out mutually shared variance, a profile emerged that portrays those respondents with more years in the profession, general responsibilities, director/manager positions and recent hiring experience as rating job duties on both dimensions differently than respondents characterized as newer in the profession who carry out specialized functions, are in supervisors (or "other") positions, and have not hired a new graduate recently. Ironically, those closer to a new graduate in age, task assignment, and level were more critical of the competencies of new members.

Membership in one of the three sponsoring organizations failed to contribute. After all is said and done, it's individual characteristics rather than organizational membership that are driving perceptions. There is some evidence that ASCP members view several dimensions differently; these differences are associated with the organization and suggest the organization's mission or policy position on this issue may influence members.

Ranking. Respondents were asked to rank the nine major competency areas (defined by the investigators) from 1 (most important) to 9 (least important). The nine areas do not exactly match with the six functions identified by the factor analysis. At this stage, a simple comparison of the values assigned the ranking and the importance shed light on the consistency of the respondents. We would expect to find the same pattern. Means of the nine competency areas are provided in Table 7.

Table 6. Beta Coefficients and T Values (Significance <.05) for Regression of Importance and Competency Scales

A. Importance	Leadership/Mgt		Work Behavior		Data Analysis		Problem Solving		Problem Sensing		Data Collection	
	B	T	B	T	B	T	B	T	B	T	B	T
Constant	37.53	72.54	28.09	237.34	29.90	143.66	16.33	150.68	22.55	361.60	10.25	150.04
Yrs Superv Exp	.15	4.36	.03	2.78	--	--	.02	2.94	.01	2.76	--	--
Responsibility	1.70	3.17	--	--	.55	3.26	.28	2.49	--	--		
Position	--	--	.32	2.03	--	--	--	--	--	--	--	--
Last Hire	--	--	--	--	.21	3.15	--	--	--	--	--	--
Yrs Current Pos	--	--	--	--	.03	2.65	--	--	--	--	--	--
B. Competency												
Constant	32.012	78.02	22.29	180.48	23.18	147.94	12.49	106.29	no variables		8.26	124.96
Yrs Superv Exp	.07	2.19	--	--	--	--	--	--	met		--	--
Yrs Current Pos	.08	2.30	--	--	--	--	.03	3.72	criteria		--	--
Responsibility	1.29	3.08	--	--	.97	4.43	.56	4.40			.26	2.85
Position	--	--	-.66	-2.91	--	--	--	--			--	--

Table 7. Mean Rankings of Nine Competency Areas

	Mean Rank[1]	Rank
Specimen Collection/Processing	4.08	3
Perform Analytical Tests	1.84	1
Clinical Correlation/Quality Assurance	3.54	2
Preventive/Corrective Maintenance	4.30	5
Method Evaluation/Research & Development	7.22	7
Professional Skills	4.20	4
Teamwork	4.37	6
Management and Supervision	7.60	8
Educational Methods	7.73	9

[1]1 (most important) to 9 (least important)

The lowest ranking went to management and supervision and educational methods. These were also the lowest rated job duties based on importance. Beyond this point, however, there existed more disagreement than agreement. The rankings placed analytical skills at the top (areas of analytical tests, collection/processing, and clinical correlation) while work behaviors were in the middle. The importance ratings were just reversed. Thus, respondents are sending mixed messages. Granted, the question is slanted toward curricula planning where analytical skills predominate; nevertheless, without similar priority given to work behaviors, gains in technical performance through improved education would be offset.

Through the use of MANOVA's, cohorts could be tested to see if they had the same ranking patterns (ranked at the same weight). MANOVA's for GROUP, even with covariants, was significant (F=2.089, .004). This means that ASMT, ASCP, and CLMA weighted the factors differently which may have shifted their rank orders. POSIT and RESPON also had significant MANOVA's. The results for GROUP are presented in Table 8. Results for other MANOVA's are available from the author.

Table 8. Rankings of Nine Competency Areas by Group Membership (Means)

	ASCP		ASMT		CLMA	
	Mean	Rank	Mean	Rank	Mean	Rank
Specimen Collection	4.11	3	4.01	3	4.07	3
Analytical Tests	1.83	1	2.03	1	1.75	1
Clinical Correlation	3.57	2	3.60	2	3.44	2
Maintenance	4.33	5	4.33	6	4.21	4
Method Evaluation	7.26	7	7.22	7	7.10	7
Professional Skills	4.12	4	4.06	4	4.44	6
Teamwork	4.40	6	4.16	5	4.42	5
Management	7.66	8	7.45	8	7.54	8
Educational Methods	7.68	9	7.73	9	7.89	9

The rating weights varied to a small degree with ASMT respondents placing more emphasis on work behaviors and slightly less on analytical tests. Ranking patterns are affected among the middle segment of competencies (4, 5 and 6); top and bottom rankings were unaffected.

SECTION III. IMPLICATIONS

In one sense the results of this study should not surprise anyone; they confirm conventional wisdom that new graduates do not possess the appropriate skills at competency levels able to sustain high performance. The surprise among medical laboratory professionals may come from the higher importance ratings given to work behaviors and life skills at the expense of academic based technical skills. In other words, new hires lack the skills and experiences to adapt to the workplace (often referred to as socialization) which affects their technical performance, regardless of their technical competencies.

This situation is consistent with results from employers of graduates from other disciplines and self-reported information from new graduates. New graduates indicated that they had problems in early socialization with communication (organization often ineffective), formal and informal power networks, and teamwork. They reserved their biggest concerns to: (1) not having enough applied experience with their theoretical academic skills (high on theory, low on practice); and (2) lack of life skills of managing a budget, developing new friendships, and handling stress which are soon carried into the workplace. On top of that, there are well-documented, often anecdotal, evidence of lifestyle, value conflicts between today's graduates (busters) and their managers (boomers).

While laboratory managers look to the educational institutions to prepare better students, the responsibility does not solely reside there. Many job competencies are shaped by the work environment. An environment of neglect can foster poor work habits, depress performance, and reduce job satisfaction. From my work on turnover in medical laboratories, the evidence is clear that lab environments are often under staffed and stressful; the profession's status is low; and career mobility is limited. Restricted financial resources (as health facilities scurry to contain costs) only acerbate these problems for laboratory workers. Even if educational institutions produced the perfect technologist, the technologist would not be successful in today's laboratory environment. Improving new graduates' work performance is going to take more than educational reform; it also requires a transformation of the workplace.

From the rankings of important job skills, it appears that job duties do not mesh with educational preparation. Set aside the work behavior/teamwork type of skills --- skills that everyone needs regardless of education level --- and focus on the technical skills and leadership/management skills. There seems to be three core sets of technical skills: specimen collection, analysis/equipment operation, and result interpretation/communication. It seems that two different employees are defined: a technician to perform basic operations and an analyst (technologist) to verify, interpret, and explain results. It could be argued that the recruitment of four-year graduates may be ill-advised for the majority of laboratory duties. With no emphasis on leadership/management skills, skills fostered at four-year programs, there is even less incentive for four-year graduates to pursue a position in a laboratory.

Attention needs to be given to describing appropriate positions (career ladder) in laboratories and commensurate education requirements. The tendency is to hire someone "just like me" and for a laboratory manager or supervisor that means a four-year degreed candidate. Evidence from laboratory hiring practices showed a strong affinity for hiring four-year degree holders (only hire two-year degreed

applicants if other type of applicant not available). The problem is that too many four-year degree students, and not enough two-year graduates, are being hired. A closer examination of education level, job requirements, and laboratory responsibilities should be undertaken.

Factors that appear to influence ratings included position respondent held in the laboratory and the type of responsibilities the respondent performed. The higher the position and the more general the responsibilities, raters were more favorably inclined toward new graduates. Nevertheless, there are very negative perceptions across the profession about the capabilities of new hires. These deep seated beliefs are going to be difficult to dislodge, regardless of the programs initiated to correct the problem. It will be even more difficult for professionals, educators, and students to quit pointing fingers and join together to improve their profession.

Besides the concerns outlined at the beginning of this paper, a word of caution. These job duties reflect the clinical laboratory of today. What will the most important job duties be in ten years, given technological advances, a restructured health delivery system, and changing work expectations. Changing the laboratory work environments and adjusting educational program emphasis should address future needs rather than respond to today's situation.

APPENDIX A
Mean Scores for Importance & Competency by Cohort

	Importance						Competency					
	Lead./ Manage.	Work Behav.	Data Analysis	Prob. Solv.	Prob. Sens.	Data Coll.	Lead./ Manage.	Work Behav.	Data Analysis	Prob. Solv.	Prob. Sens.	Data Coll.
Group												
1 ASCP	39.24	28.23(2,3)	30.71	16.57(2,3)	22.64	10.44(2)	33.77	22.23	23.45	12.88(2,3)	17.89	8.30(1)
2 ASMT	42.68(1,3)	28.96	31.17	17.04	22.82	10.69	35.80(1,3)	22.51	24.60(1)	13.45	17.95	8.67
3 CLMA	40.46	28.58	31.09	16.87	22.72	10.61	33.98	21.89	23.84	13.30	17.66	8.40
Position												
1 Director	41.40	28.63	30.80	17.02	22.68	10.62	34.57	21.75	23.87	13.26	17.57	8.38
2 Manager	41.22(3,4)	28.78(3,4)	31.22(3)	16.91	22.73	10.68	34.65	21.80	24.03(3)	13.28(3)	17.61	8.56
3 Supervisor	39.38	28.28	30.63	16.56	22.67	10.46	33.76	22.17	23.33	12.87	17.76	8.27
4 Other	38.88	28.24	30.86	16.72	22.63	10.42	33.84	22.43	24.01	13.14	18.12	8.32
Responsibility												
0 Specialist	39.26	28.34	30.67	16.60	22.72	10.38	33.53	22.23	23.31(1,2)	12.88(1,2)	17.84	8.25(1)
1 Generalist	41.24(1)	28.58	31.17(1)	16.86(1)	22.64	10.73(1)	35.10(0)	22.05	24.18	13.21	17.82	8.52
2 Other	39.94	28.27	30.89	16.80	22.63	10.52	33.83	22.42	24.22	13.51	17.97	8.47
Hospital												
1 Hospital	39.40	28.40	30.91	16.64	22.66	10.51	33.71	21.97	23.69	12.93	17.79	8.51
2 Indep. Lab	40.74	28.31	30.68	16.90	22.68	10.45	34.08	22.36	23.37	13.16	17.53	8.32
0 Other	41.04(1)	28.49	30.85	16.79	22.74	10.54	34.98(1)	22.60(1)	23.88	13.30(1)	18.09(2)	8.29
Last Hire												
0 Missing, None	40.67	28.40	30.66	16.71	22.67	10.55	34.51	22.39	23.62	13.12	18.03	8.43
1 < 1985	40.50	28.58	30.82	16.51	22.71	10.64	35.29	22.90	24.50	12.95	18.33	8.45
2 1986-1989	39.43	28.23	30.86	16.82	22.64	10.57	33.82	22.34	23.72	13.01	17.74	8.50
3 1990-1993	39.63	28.44	31.01	16.71	22.71	10.46	33.72	21.92	23.65	13.05	17.68	8.29

( ) Significantly different at the .05 level