RESEARCH

The Learning and Application of Generic Skills by CLSs/MTs Who Have 'Left The Field'

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OBJECTIVE: To determine whether generic skills that clinical laboratory scientists (CLSs)/medical technologists (MTs) learned as students and/or practitioners are applied to jobs outside the field of CLS/MT; and to determine if there are any significant differences in learning and/or doing these skills by CLS/MT majors vs. non-CLS/MT majors.

DESIGN: An Occupational Change Survey was sent to CLS/MT practitioners who had identified themselves as having left the field (LTF) of CLS/MT. The participants were asked whether or not they were CLS/MT majors as undergraduates, whether they utilized generic baccalaureate level skills in their LTF jobs, and whether or not they learned these skills as CLS/MT students and/or practitioners. The skills were: problem solving, decision making, troubleshooting, analytical reasoning, data correlation, precision studies, quality assessment, teaching, research, communication, technical writing, computer use, utilization review, and supervision.

SETTINGS AND PARTICIPANTS: The survey was sent to 105 participants of an ongoing longitudinal study who identified themselves as having LTF.

MAIN OUTCOME MEASURES: Responses for doing/utilizing the skills were grouped as 'Yes' if participants indicated they frequently or sometimes used the skills in their LTF jobs, and 'No' if they indicated they rarely or never used the skills in their LTF jobs. Responses for learning the skills were grouped as 'Yes' if participant indicated they learned the skills as CLS/MT students, practitioners or both and 'No' if they indicated they never learned the skills as CLS/MT students, practitioners, or both. Participants indicated whether or not they were CLS/MT majors in college. Chi square analyses were performed to test for any statistical significant (p = 0.05) differences between: doing and learning the skills, doing the skills and being a CLS/MT major, and learning the skills and being a CLS/MT major.

RESULTS: The response rate for the survey was 48% (50/103). Chi square analyses could not be performed for doing the skills in the LTF jobs for three variables: problem solving, analytical reasoning, and computer use because all respondents reported that they used these skills. Chi square analyses indicated there were no significant differences between doing and learning the skills in the LTF job for the entire sample group for all remaining skills except supervision. There were no significant differences between doing the skills in the LTF job and being a CLS/MT major. A statistically significant difference in learning the skills was observed between CLS/MT majors and non-CLS/MT majors for the following skills: problem solving, correlating data, precision studies, research, analytical reasoning, and troubleshooting. The 'Yes' answer frequencies for learning the skills was higher for the CLS/MT majors for all the generic skills except teaching, where they were equal, and utilization studies where they were lower.

CONCLUSION: The results indicate that, in general, for this sample group, generic skills learned as CLS/MT students and/or practitioners can be and are applied to a wide variety of LTF jobs. Furthermore, CLS/MT majors learned the generic skills at least as well, if not better, than other baccalaureate level laboratory practitioners who obtained degrees in other areas.

ABBREVIATIONS: ASCP-BOR R&D (Committee) = American Society of Clinical Pathologists Board of Registry Research and Development (Committee); CLS = clinical laboratory scientist; LTF = left the field; MT = medical technologist; N-CLS/MT (major) = non-clinical laboratory scientist/medical technologist (major).

INDEX TERMS: baccalaureate level generic skills; CLS/MT career patterns; CLS/MT education; occupational change.

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Research, reports, and discussion in literature have repeatedly shown that clinical laboratory scientists (CLSs)/medical technologists (MTs) work in a variety of jobs and professions.[1-5] Some of these jobs may be seen as being an expansion of the traditional role of a baccalaureate level laboratory practitioner, e.g., quality control/quality assurance coordinator, technical consultant; whereas others, further removed from the laboratory setting, e.g., insurance claims adjuster, school teacher, may be considered 'outside the field'. Although the economic climate for healthcare institutions during the mid 1990s was not conducive to increasing or replacing laboratory staff, various career opportunities opened up in healthcare and other industries to which CLSs/MTs readily adapted.

Baccalaureate level CLS/MT curricula emphasize certain generic skills that produce graduates who are flexible and can readily adapt to new instrumentation, protocols, or a changing laboratory and/or healthcare institutional environment. The same qualities, which today's laboratory employers are demanding of their personnel, empower CLSs/MTs to transcend their traditional roles of reliable bench practitioners to a vast array of occupations, professions, and career opportunities. Such skills include: problem solving, decision making, troubleshooting, analytical reasoning, data correlation, precision studies, quality assessment, teaching, research, communication, technical writing, computer use, utilization review, and supervision. These 'high level' skills are integrated into the competencies for CLSs/MTs as described by the National Accrediting Agency for Clinical Laboratory Sciences (NAACLS) *Essentials of Accredited Educational Programs for the Clinical Laboratory Scientist/Medical Technologist*.[6] The importance of facilitating students' acquisition and refinement of these skills is widely accepted by the CLS/MT community.[7-14]

The repercussions of the mid 1990s healthcare economic climate of mergers, capitation, and job freezes changed the opportunities for CLS/MT practitioners and new graduates. Both groups were lured away from the traditional hospital bench work by opportunities within other sectors of the healthcare industry and by other industries that have begun taking notice of the abilities and skills of CLSs/MTs. Many times these alternative non-traditional jobs provide better salary and/or hours; or are perceived as being more interesting than traditional bench work.

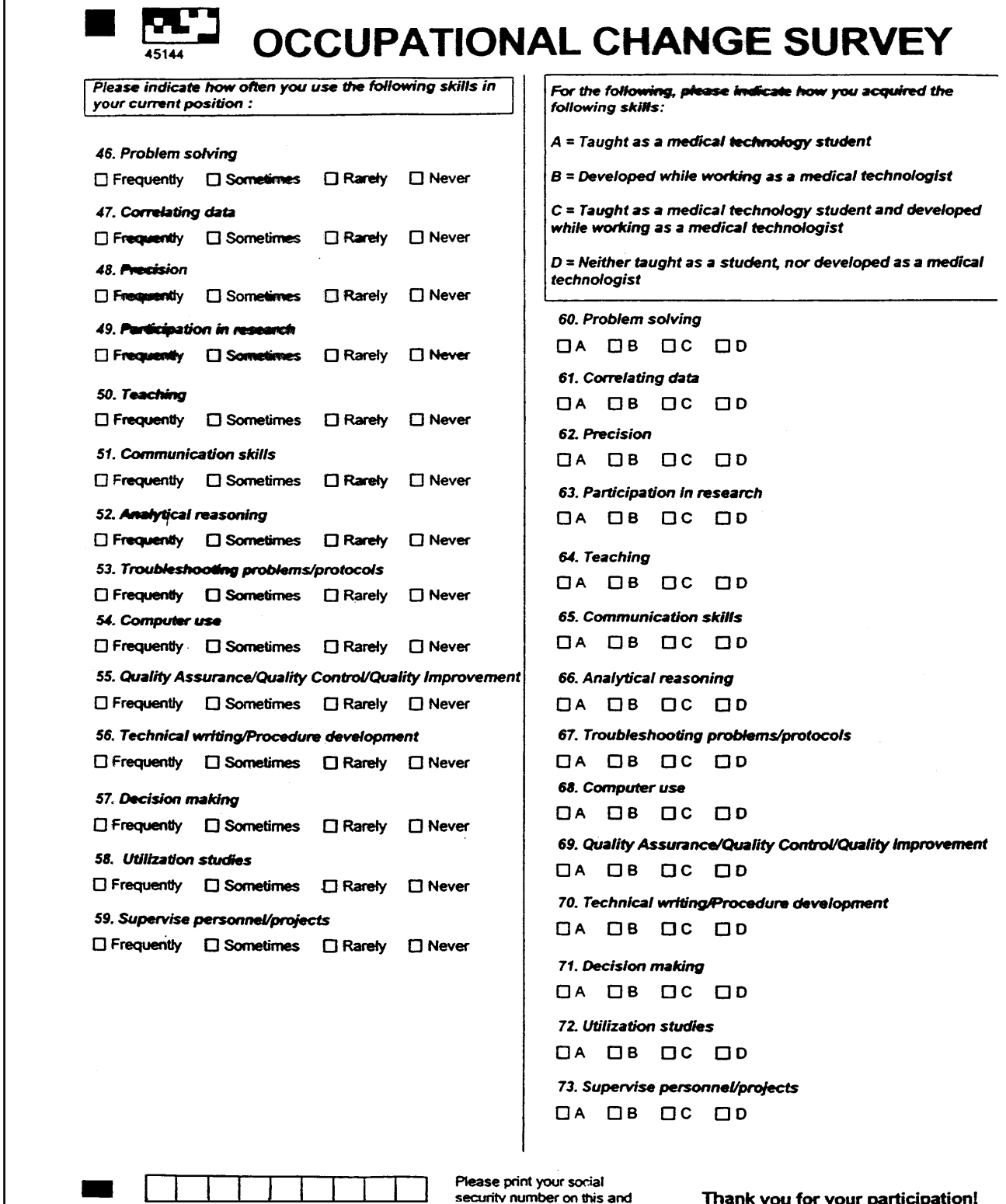
In 1993 the American Society of Clinical Pathologists Board of Registry (ASCP-BOR) Research and Development (R&D) Committee began a ten-year nationwide longitudinal study of career patterns of newly certified MTs. During the study, a cohort of the sample group indicated that they had 'left the field' (LTF). A question arose as to what generic skills this subgroup utilized in their new jobs that they had learned as CLS/MT students and/or practitioners. Consequently, an Occupational Change Survey was sent to this cohort inquiring whether they used the generic skills in their new jobs; and whether they learned these skills as either or both CLS/MT students and practitioners (Figure 1). A statistical analysis of the data was proposed to determine whether there was a significant difference between learning the skills as CLSs/MTs, and applying or 'doing' the skills at the LTF jobs. No significant difference was expected between doing and learning the skills. If the sample group learned the skills as CLS/MT students and/or practitioners, then these skills would be used in the LTF jobs. Furthermore, data were available to compare graduates of NAACLS accredited CLS/MT programs (CLS/MT majors) to non-CLS/MT (N-CLS/MT) majors to see if there was any significant difference between the groups in doing or learning these skills. Using the same line of reasoning as above, no significant difference was expected between these groups in doing these skills, if their jobs required them to use the skills. However, because of the emphasis placed on these types of skills by NAACLS accredited CLS/MT programs, it was proposed that a significant difference would be seen in learning the skills between CLS/MT vs N-CLS/MT majors.

MATERIALS AND METHODS

In January 2000 the Occupational Change Survey developed by the ASCP-BOR R&D committee was sent to 103 individuals who had identified themselves as having 'left the field' (LTF) during the course of the ten-year longitudinal study (Figure 1). There were 50 responses to the survey representing a 48% response rate. Usable responses varied from 50 (48%) to 41 (39%) depending upon the variable analyzed. For example, the ASCP-BOR primary route for candidates who sit for its MT exam is graduation from a NAACLS accredited program leading to a baccalaureate degree in CLS/MT. A second examination eligibility route requires a baccalaureate degree, but not specifically from a NAACLS accredited CLS/MT program. Thus individuals in the LTF cohort could be divided into those who were CLS/MT majors (n = 35, 70%) or non-CLS/MT (N-CLS/CLS) majors (n = 15, 30%). For each of the 14 skill areas, respondents were asked to determine how often each skill was used in their current LTF jobs (frequently, sometimes, rarely or never). Because of statistical constraints resulting from the scarcity of replies in some categories, the data were regrouped. Frequently and sometimes replies were regrouped into 'Yes,' (used in the LTF jobs) and rarely and never replies into 'No' (not used in the LTF jobs) answers. Likewise, replies for learning the skills as CLS/MT students, practitioners, or both as students and practitioners were regrouped into 'Yes' (learned the skills as CLS/MT students and/or practitioners) and 'No' if the participants said they never learned the skills as CLS/MT students and/or practitioners.

Three major chi square analyses were performed: 1) CLSs/MTs learning the skills vs doing the skills in their current LTF jobs, 2) being a CLS/MT or N-CLS/MT major vs doing the skills in the LTF jobs, and 3) being a CLS/MT or N-CLS/MT major vs learning the skills. These lines of analyses allowed for observing whether there was a significant (p = 0.05) difference between groups for each generic skill. Statistical analyses were done using the *JMP* (SAS Institute, Cary NC) statistical program.

Figure 1



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OCCUPATIONAL CHANGE SURVEY

Please indicate how often you use the following skills in your current position :

46. Problem solving
☐ Frequently ☐ Sometimes ☐ Rarely ☐ Never

47. Correlating data
☐ Frequently ☐ Sometimes ☐ Rarely ☐ Never

48. Precision
☐ Frequently ☐ Sometimes ☐ Rarely ☐ Never

49. Participation in research
☐ Frequently ☐ Sometimes ☐ Rarely ☐ Never

50. Teaching
☐ Frequently ☐ Sometimes ☐ Rarely ☐ Never

51. Communication skills
☐ Frequently ☐ Sometimes ☐ Rarely ☐ Never

52. Analytical reasoning
☐ Frequently ☐ Sometimes ☐ Rarely ☐ Never

53. Troubleshooting problems/protocols
☐ Frequently ☐ Sometimes ☐ Rarely ☐ Never

54. Computer use
☐ Frequently ☐ Sometimes ☐ Rarely ☐ Never

55. Quality Assurance/Quality Control/Quality Improvement
☐ Frequently ☐ Sometimes ☐ Rarely ☐ Never

56. Technical writing/Procedure development
☐ Frequently ☐ Sometimes ☐ Rarely ☐ Never

57. Decision making
☐ Frequently ☐ Sometimes ☐ Rarely ☐ Never

58. Utilization studies
☐ Frequently ☐ Sometimes ☐ Rarely ☐ Never

59. Supervise personnel/projects
☐ Frequently ☐ Sometimes ☐ Rarely ☐ Never

For the following, please indicate how you acquired the following skills:

A = Taught as a medical technology student

B = Developed while working as a medical technologist

C = Taught as a medical technology student and developed while working as a medical technologist

D = Neither taught as a student, nor developed as a medical technologist

60. Problem solving
☐ A ☐ B ☐ C ☐ D

61. Correlating data
☐ A ☐ B ☐ C ☐ D

62. Precision
☐ A ☐ B ☐ C ☐ D

63. Participation in research
☐ A ☐ B ☐ C ☐ D

64. Teaching
☐ A ☐ B ☐ C ☐ D

65. Communication skills
☐ A ☐ B ☐ C ☐ D

66. Analytical reasoning
☐ A ☐ B ☐ C ☐ D

67. Troubleshooting problems/protocols
☐ A ☐ B ☐ C ☐ D

68. Computer use
☐ A ☐ B ☐ C ☐ D

69. Quality Assurance/Quality Control/Quality Improvement
☐ A ☐ B ☐ C ☐ D

70. Technical writing/Procedure development
☐ A ☐ B ☐ C ☐ D

71. Decision making
☐ A ☐ B ☐ C ☐ D

72. Utilization studies
☐ A ☐ B ☐ C ☐ D

73. Supervise personnel/projects
☐ A ☐ B ☐ C ☐ D

Please print your social security number on this and

Thank you for your participation!

RESULTS

The types of LTF job titles reported are listed in Table 1. The job titles are separated, somewhat arbitrarily into 'CLS/MT related/expanded titles' and 'lesser related titles'. The job titles were almost as diverse as the number of respondents. Some of the CLS/MT related titles are located outside the hospital/clinical setting, may be cross related, and/or represent the same or similar functions, e.g., testing manager, data manager, clinical projects manager, laboratory analyst.

Tables 2 and 3 list the frequencies for doing and learning the skills respectively. Table 2 lists the frequencies reported for utilizing or doing the skills on the LFT jobs, and Table 3 lists the frequencies of learning the skills broken down into CLS/MT majors and non-CLS/MT majors. Three of the generic skills: problem solving, analytical reasoning, and computer use had a 100% response rate, indicating that all the participants reported use of these skills in their current jobs. Generally, the reported frequencies of doing the skills were higher than learning the skills. For most of these skills the doing or yes response frequencies were above 80%. The lowest skill frequency in this category was utilization studies (70%). Seven of the 14 skills were reported as being learned by 60% or more of the CLS/MT majors, whereas only one skill, quality assessment, was reported as being learned by 60% or more of the N-CLS/MT majors. The two lowest ranking skills learned by the CLS/MT majors were supervision (31%) and utilization studies (41%). For the N-CLS/MT majors they were research (17%) and computer use (23%).

To determine if there were any meaningful differences in the entire sample group between doing and learning the skills, a chi square analysis was done for each skill variable. These results are shown in Table 4. The three skills with a 100% doing rate could not be compared as these variables were not dichotomous. There was no statistically significant ($p = 0.05$) difference observed between doing and learning the variables for any skill except supervision.

Table 1. Types of left-the-field reported jobs

CLS/MT related/expanded titles	Lesser related titles
Epidemiologist	Senior Life Insurance Underwriter
Quality Improvement Analyst	Claims Processor
Infection Control/QA Analyst	Director of Residential Management
Research Associate	Integration Engineer
Clinical Applications Specialist	Medical/Technical Writer
Clinical Systems Specialist	College Professor
Laboratory Analyst	Graduate Assistant
Testing Manager	Post Doctorate Fellow
Data Manager	Chemistry School Teacher
Clinical Projects Manager	Science Teacher
Manager/Assistant Manager	Adult Education Teacher
Clinical Product Manager	ESL Instructor
Sales Manager	Physician Assistant
Account Manager	Doctor of Osteopathy
Technical Services Manager	Medical Doctor/Resident
Hematology Customer Service Representative	Medical student
Technical Specialist	Dental student
Consultant	
Educational Coordinator	
MLT Instructor	

Because the ASCP-BOR has various routes of eligibility for its MT examination and the overall respondent rates for learning these skills were relatively low, it was considered useful to compare learning and doing the skills according to whether or not the respondents were CLS/MT majors. These data are depicted in Tables 5 and 6. As expected, there were no significant differences in doing the skills in the LTF jobs between CLS/MT and N-CLS/MT Majors (Table 5). However, there were some significant differences seen between CLS/MT and N-CLS/MT majors in terms of learning the skills (Table 6).

There was a significant ($p = 0.05$) difference observed between CLS/MT and N-CLS/MT majors in learning the following skills: problem solving, correlating data, precision studies, research, analytical reasoning, and troubleshooting. For all of these variables, the CLS/MT major reported higher frequencies of learning than did the N-CLS/MT majors. In fact, the CLS/MT majors reported higher frequencies of learning these skills than did the N-CLS/MT majors for all of the generic skills except teaching where they were the same and utilization studies where the N-CLS/MT majors reported a higher frequency of learning (Table 3).

DISCUSSION AND IMPLICATIONS

The data show that CLSs/MTs who consider themselves as having LTF are able to apply high level generic skills they learned as CLS/MT students and/or practitioners to their LTF jobs. Educators of these graduates should be satisfied in knowing that the skills that were inchoated into students in a CLS/MT curriculum can be, and are, applied to a wide variety of occupations/professions. Thus the marketablitiy of CLS/MT graduates appears to transcend

the short term economic climate of the laboratory. These empirical findings should help educators promote their programs within universities and serve as a recruitment tool for potential students.

Table 2. Frequency of doing skills in left-the-field jobs

Generic skill	% doing at left-the-field job
Problem solving	100
Correlating data	97
Precision studies	88
Participate in research	71
Teaching	95
Communication	98
Analytical reasoning	100
Troubleshooting	95
Computer use	100
Quality assurance	79
Technical writing	73
Decision making	98
Utilization studies	70
Supervise people/projects	76

These generalizations, however, must be tempered with the fact that all participants in the sample were MTs. Some qualified for the ASCP certification examination by alternate routes, and thus a dichotomy could be made between CLS/MT and N-CLS/MT majors. The study is not comparing CLS/MT to other allied health or liberal arts majors per se, but CLS/MT program graduates to alternate route candidates who needed baccalaureate degrees in some area to qualify for the examination. The majority of participants in the longitudinal study who did qualify for the ASCP-BOR examination by alternate routes were CLTs/MLTs with experience, who then earned baccalaureate degrees.[15]

Recognizing that CLSs/MTs are prepared to work in a variety of occupations is not new to the CLS/MT community. In previous studies, program graduates have reported the importance of generic skills to their careers inside and outside the field of CLS/MT.[1,4] Even before the healthcare institution reorganization/'right sizing' trend began, reports showed that CLS/MT graduates were not only thoroughly prepared for careers in the laboratory, but they could also "select from a wide array of opportunities both within and outside the traditional hospital setting".[3] The current study gives empirical evidence from a national data base that graduates use their skills in a wide variety of occupations. Although the news may be good for educators looking to increase enrollments in their programs, it may not be good for traditional employers who want those graduates working in their laboratories.

Table 3. Frequencies of learning skills by CLS/MT majors and non CLS/MT majors

Generic skill	Frequency MT/CLS major learning skill n/tng*	Frequency non-MT/CLS major learning skill n/tng*	Total n reporting on skill
Problem solving	82 (28/34)	54 (7/13)	47
Correlating data	89 (31/35)	54 (7/13)	48
Precision studies	88 (30/34)	54 (6/11)	45
Participate in research	53 (18/34)	17 (2/12)	46
Teaching	45 (15/33)	45 (5/11)	44
Communication	54 (19/35)	50 (6/12)	47
Analytical reasoning	79 (26/33)	45 (5/11)	44
Troubleshooting	85 (28/33)	50 (5/10)	43
Computer use	41 (14/34)	23 (3/13)	47
Quality assurance	94 (33/35)	85 (11/13)	48
Technical writing	53 (18/34)	45 (5/11)	45
Decision making	65 (22/34)	58 (7/12)	46
Utilization studies	41 (13/32)	54 (6/11)	44
Supervise people/projects	31 (11/35)	22 (2/9)	44

*n/tng, n = number reporting learning the skill in each sub group, tng = total number in each sub group, i.e., MT/CLS majors or non MT/CLS majors reporting for each skill.

Table 4. Chi square analysis doing vs. learning skills in left-the-field jobs: total sample data

Generic skill	Chi Square	Probability*
Problem solving	N/A†	N/A†
Correlating data	0.517	0.4722
Precision studies	0.031	0.8595
Participate in research	0.206	0.6499
Teaching	0.011	0.9178
Communication	2.301	0.1293
Analytical reasoning	N/A†	N/A†
Troubleshooting	1.572	0.2099
Computer use	N/A†	N/A†
Quality assurance	2.506	0.1134
Technical writing	1.268	0.2601
Decision making	3.475	0.0623
Utilization studies	1.321	0.2503
Supervise people/projects	8.852	0.0029*

* Significant at $p < 0.05$
† N/A, non applicable, analysis could not be done because all participants (100%) reported doing these skills in their left-the-field job

Table 5. Chi square analysis of doing skills at left-the-field job vs. being a CLS/MT major

Generic skill	Chi Square	Probability*
Problem solving	N/A†	N/A†
Correlating data	0.755	0.3850
Precision studies	0.629	0.4279
Participate in research	2.163	0.1414
Teaching	0.892	0.3448
Communication	0.794	0.3730
Analytical reasoning	N/A†	N/A†
Troubleshooting	1.245	0.2646
Computer use	N/A†	N/A†
Quality assurance	1.943	0.1634
Technical writing	0.011	0.9158
Decision making	0.875	0.3497
Utilization studies	0.059	0.8074
Supervise people/projects	0.837	0.3603

* No variable was significant at $p < 0.05$
† N/A, non applicable, analysis could not be done because all participants (100%) reported doing these skills in their left-the-field job

The question as to whether the CLS/MT programs are doing a disservice to laboratory employers and the professional community by making graduates aware that the skills they learn are transferrable and marketable to an array of occupations has been debated.[2-4] Many of the non-traditional jobs are located in the same healthcare institutions where the laboratories are found. Thus the practitioners apply their talents for the good of these institutions in general, although maybe not for the laboratory in particular. In the laboratory setting, managers/supervisors are asking more of their CLS/MTs, thus changing job descriptions and making CLSs/MTs more aware of the talents they have. The impetus for many of today's jobs, e.g., compliance officer, quality assurance coordinator, comes from the government and other regulating bodies which are requiring hard data that can be best accessed, organized, and understood by CLSs/MTs. These types of jobs afford a real opportunity for new graduates and practitioners to fully utilize their skills and knowledge. If there is a shortage of qualified personnel, employers should become aware that they are competing with other departments within their institution, other professions and corporations for these personnel, and the bottom line is salaries. Thus it is expected that salaries will need to rise to attract qualified CLSs/MTs. Even if graduates move away from the traditional healthcare setting, they may find themselves in positions where they can champion the cause of the profession and understand the constraints that go along with it. As noted by Spannaus-Martin, there is nothing wrong in the perception that "Once an MT, always an MT… A person does not stop being a medical technologist just because they are no longer working in a laboratory".[2] In fact, they may do more good for the profession if they are working on the outside, e.g., physician, hospital or company administrator, insurance representative, school teacher.

A few comments regarding the aberrations of some results are in order. The first refers to the relatively low frequencies for learning computer skills for both CLS/MT and N-CLS/MT majors. This sample group took the ASCP-BOR MT examination in 1993. The personal computer and Internet revolution occurred throughout the 90s and is continuing today. It is believed that almost all professional workers utilize a computer, as can be seen in the 100% response rate for doing the computer use skill. It is expected that today most if not all CLS/MT curricula include use of personal computers and access to Internet sites. So these data are probably outdated. In the total sample, there was a significant difference between doing and learning supervision skills (Table 4). Here 76% of the respondents said they use this skill (Table 2), but only 29% ((11 CLS/MT majors +2 N-CLS/MT majors)/44) of the total sample reporting learned it. This was the only significant difference between doing and learning a skill for the overall sample group.

Table 6. Chi square analysis of learning generic skills vs being a CLS/MT major

Generic skill	Chi Square	Probability
Problem solving	8.672	0.0043*
Correlating data	14.731	0.0001*
Precision studies	5.896	0.0152*
Participate in research	10.932	0.0009*
Teaching	0.013	0.9076
Communication	0.127	0.7216
Analytical reasoning	10.730	0.0011*
Troubleshooting	11.963	0.0005*
Computer use	3.208	0.0733
Quality assurance	2.334	0.1266
Technical writing/	0.409	0.5222
Decision making	0.425	0.5146
Utilization studies	1.382	0.2397
Supervise people/projects	0.485	0.4861

* Significant difference between CLS/MT major vs N-CLS/MT major groups at $p < 0.05$.

It appears that supervision responsibilities are widespread in the types of LTF jobs CLS/MTs take, but are not equivalently stressed or practiced in curricula and/or the profession itself. That inconsistency, however, is probably also being addressed today from a national program accreditation standpoint. Finally, although not significant, N-CLS/ MT majors reported higher frequencies for learning utilization studies than did CLS/MT majors (Table 3). If the reported alternate certification route for N-CLS/MT majors in this study was primarily CLTs/MLTs who acquired baccalaureate degrees then it is very possible that these individuals learned to do utilization studies before they took the MT certification exam or worked as CLS/MT practitioners.[15]

LIMITATIONS AND CONCLUSIONS

In evaluating the findings, it must be noted that the number of respondents is relatively low especially when categorizing them into CLS/MT and N-CLS/MT majors. Consequently the conclusions may not extend much past the sample group. Furthermore, the results were based on self reporting. It was the participants who described themselves as having LTF. They also may have had their own ideas or definitions for what each skill title meant. For example, the meaning of 'utilization studies' is that the laboratory services/tests are used properly for given situations and patients. Clarity of terms is a problem of all survey research. On the other hand, it should be understood how difficult it is to find an objective, bonafide sample of CLS/MTs who work in other professions, and who are willing to answer survey questions relating to the field they left. The sample was drawn from a national data base of all candidates taking the ASCP-BOR MT examination in 1993. Thus the study data may be representative of the types of jobs CLS/MTs take and/or their expanded career opportunities; and the generic skills they believe apply to their current jobs which they learned as CLS/MT students and/or practitioners. Even with a relatively small sample group, this interpretation is consistent with that of other studies.[1,3,4]

It is concluded that, for this sample, CLS/MT majors learn generic skills as part of their curriculum at least as well, if not better, than CLSs/MTs who obtained their baccalaureate degree in other areas. This information should be useful to educators justifying costs vs outcomes of CLS/MT programs, and important to employers who want applicants who are flexible, have transferrable skills, can adapt to a variety of work requirements, and successfully perform complex tasks demanded of them.

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