Medical Laboratory Science Undergraduate Management Curriculum Development Using Practitioner-reported Job Tasks

SUSANNE BISHOP, KAREN HONEYCUTT

ABSTRACT

A Midwestern medical laboratory science (MLS) program conducted an online survey as part of a larger national study to assess what specific management skills staff-level MLS practitioners were performing as part of their job. The survey provided data that helped guide management-related curriculum development. Participants self-reported how often (ie, often, sometimes, never) they had been asked, as part of their staff-level job, to perform a list of 30 managerial tasks. Frequently performed tasks (ie, percentages represent both the "often" and "sometimes" responses) included training laboratory staff (88%); performing or participating in equipment/method validation (82%); preparing for/participating in laboratory inspection/assessment (82%); ensuring compliance of regulations/standards (76%); monitoring quality via quality indicators (64%); investigating standard operating procedure/policy deviations (65%); analyzing/reviewing inventory data (65%); planning, measuring, and evaluating process improvement projects (61%); developing competency assessment materials (61%); revising or writing policies and procedures (61%); and participating in interdisciplinary teams (61%). Least-performed tasks identified included hiring new employees (2%); preparing a laboratory/department budget (3%); performing a strengths, weaknesses, opportunities, and threats analysis (5%); negotiating vendor contracts (8%); writing job descriptions (8%); determining productivity (11%); and performing a cost analysis (14%). The reported descriptive statistics helped distinguish between frequently and infrequently performed tasks and helped develop managerial curriculum for an undergraduate and graduate MLS program. The staff-level practitioner rarely performed financial and human resources, so these tasks became the focus of the graduate-level management curriculum.

ABBREVIATIONS: ASCLS - American Society for Clinical Laboratory Science, ASCP - American Society for Clinical Pathology, BOSR - Bureau of Sociological Research, BS - Bachelor of Science, BSMLS - Bachelor of Science in Medical Laboratory Science, CLS - clinical laboratory scientist, HR - human resources, LIS - laboratory information system, MLS - medical laboratory science, MMLS - Master of Medical Laboratory Science, MT - medical technologist, NAACLS - National Accrediting Agency for Clinical Laboratory Sciences, SOP - standard operating procedure, SWOT - strengths, weaknesses, opportunities, and threats analysis.

INDEX TERMS: clinical laboratory science, clinical laboratory management, curriculum, education, management education, medical laboratory science, management education.

Clin Lab Sci 2019;32(4):138–145

***Susanne Bishop**, University of Nebraska Medical Center*

***Karen Honeycutt**, University of Nebraska Medical Center*

***Address for Correspondence: Susanne Bishop**, University of Nebraska Medical Center, susanne.bishop@unmc.edu*

INTRODUCTION

A major difference between the undergraduate and graduate degrees is the amount, type, and depth of management-related content in the curriculum. Anecdotal communications to program administration that Bachelor of Science in Medical Laboratory Science (BSMLS) practitioners are promoted to managerial positions without sufficient management-related education, laboratory experience, and available mentoring are cause for concern. This issue is exacerbated by the reported clinical laboratory personnel shortage. The Bureau of Labor Statistics projects a 14% growth in workforce needs for medical laboratory science (MLS) practitioners between 2014 and 2024.[1] Additionally, the American Society for Clinical Pathology (ASCP) reported average clinical laboratory vacancies of 8.7% with a 19.2% expected retirement rate over the next 5 years.[2]

A Midwestern, 3+1, university-based, MLS program is developing a master's degree [Master of Medical Laboratory Science (MMLS)] option in addition to its traditional baccalaureate degree program (ie, the BSMLS). To provide a stronger foundation in management education, the MLS program explored the development of an MMLS option with a managerial focus. Program administration and faculty were tasked with determining and articulating the management-related curricular differences between the undergraduate and graduate degree options.

MLS curriculum focuses on the theoretical knowledge and technical skills required to perform diagnostic

testing in all clinical laboratory disciplines. In addition, management-related topics must also be taught to prepare the entry-level laboratory professional. When considering MLS program management curriculum content, resources routinely referenced to guide such development do not provide clear direction as to the specific management-related content to include.[3-5] Inconsistent terminology may intensify this ambiguity. The National Association Agency for Clinical Laboratory Science (NAACLS) program accreditation standards require inclusion of the following management-related topics: government regulations and standards, principles and practices of administration, principles and practice of quality assurance/quality improvement, and educational methodologies in MLS curricula.[3] The ASCP Board of Certification MLS exam includes questions on quality assessment and troubleshooting, purchasing, inventory control, competency, education and communication, and laboratory information systems.[4] Examples of management-related areas in the proposed, updated American Society for Clinical Laboratory Science (ASCLS) entry-level curriculum for MLS include health care reform, regulations, general and financial management theory, information systems, and human resources (HR).[5]

The literature also does not communicate clearly defined management-related content to include in MLS curricula. Beck and Doig's 2002 survey reported that educators, managers, and practitioners all agreed that clinical laboratory scientist (CLS) [MLS]-level staff members need more management and administrative skills in today's clinical laboratory. Yet, in the same survey, significant differences were found in manager and educator responses to the statement, "Baccalaureate degree CLS/[MLS] programs should focus on the sciences underlying laboratory testing, not on management and education," with managers disagreeing and educators agreeing with the statement.[6] A 2007 ASCLS white paper proposing a CLS/MLS levels-of-practice model first mentioned specific management-related practice skills for experienced Bachelor of Science (BS)-prepared practitioners with additional experience that included method evaluation/test development, point-of care oversight, and front-line supervision and training. Compliance/coding/regulatory, quality management, risk/patient safety, and operations/business management were recommended for those with a master's degree; however, the model assumes that "practitioners at each level are responsible for performing and/or supervising the duties performed at lower levels." Thus, an entry-level MLS practitioner could be expected to supervise phlebotomy, specimen processing, waived testing, core laboratory automated testing, and/or the additional skills listed for the MLT practitioner.[7]

For educators, making management-related curricular decisions can be ambiguous. To address this issue, current staff-level practitioners were surveyed to answer the primary research question, "What managerial related tasks and at what frequency are staff-level clinical laboratory practitioners performing as part of their non-managerial job duties?" The purpose of this research was to determine how frequently management-related job tasks were performed by staff-level practitioners. The resulting data will help guide management-related curriculum development that differentiates and best prepares the BS-level/entry-level and master's level practitioner.

METHODS

Data for this institutional review board–approved study were collected as part of a larger MLS practitioner managerial task performance and self-reported task preparedness online survey. The online survey was administered by a sister campus's Bureau of Sociological Research (BOSR). The BOSR collaborated with the investigators during question and survey development. When writing survey questions, investigators consulted accreditation and professional organization documents, laboratory management course resources, and personal experience. After beta-testing with a cohort known to the authors, they surveyed a convenience sample of clinical laboratory practitioners over 4 weeks using purchased ASCP and Clinical Laboratory Management Association email databases. Due to additional costs in using the purchased email lists, no reminder emails were sent. In addition to demographic information, participants self-categorized using survey-provided definitions as either a director/manager, supervisor/lead, or staff MLS. This study focused on the staff-level MLS responses. It questioned participants about how often (ie, often, sometimes, never) they had been asked to perform a list of 30 managerial tasks.

RESULTS

Response Rate

For the comprehensive survey, the total response rate of acceptable surveys (those finished in their entirety) was 242 with an overall response rate of 3%. Sixty-six respondents identified themselves as a BS-educated, certified, staff-level practitioner [ie, medical technologist (MT), CLS, MLS]. This job category/description was defined as an employee who spends less than 50% of their time directly supervising other employees, with the primary function of performing, interpreting, and resulting laboratory tests.

Demographics

The subset of survey respondents of interest (staff MT, CLS, MLS) represented males and females living in rural and urban communities with 0 to more than 30 years of experience. Respondents also held a wide range of professional certifications and worked in a variety of laboratory settings, and the highest level of education ranged from associate degree to master's degree. See Table 1.

Table 1. Demographics

Gender	Male					21%	
	Female					76%	
Community	Rural (<50 000 people)					36%	
	Urban (>50 000 people)					64%	
Years of experience	0 to <1	1–2	3–5	6–10	11–15	16–30	>30
	6%	21%	12%	8%	6%	6%	32%
Highest level of education	Associate's degree			Bachelor's degree		Master's degree	
	2%			86%*		12%	
Professional certifications held	MLT (ASCP) or CLT (NCA)						11%
	MT/MLS (ASCP) + MLT (ASCP) or CLT (NCA)						5%
	MT/MLS (ASCP), MT (AMT) or CLS (NCA)						71%
	2 or more – MT/MLS (ASCP), MT (AMT), and CLS (NCA)						3%
	2 or more – MT/MLS (ASCP), MT (AMT), and CLS (NCA) and ASCP specialist (SBB, SC, SH, or SM)						14%
	CQIA (ASQ)						2%
Laboratory setting employed in the longest	Physician's office						2%
	Hospital						86%
	Hospital and reference						7%
	Reference						3%
	Other**						2%

Abbreviations: AMT, American Medical Technologists; ASQ, American Society for Quality; CLT, Certified Logistics Technician; CQIA, Certified Quality Improvement Associate; MLT, medical laboratory technician; NCA, National Certification Authority; SBB, Specialist in Blood Bank Technology; SC, Specialist in Chemistry; SH, Specialist in Hematology; SM, Specialist in Microbiology.
*70% of these individuals earned their bachelor's degree in CLS.
** Respondents specified work setting as biotechnology.

Managerial Task Performance

Prior to data analysis, tasks were categorized into 1 of the following groups: education and training, finance, HR, quality, regulatory, and other duties and equipment acquisition/validation. Percentages reported in this section represent the combined "often" and "sometimes" responses, unless otherwise noted.

Education and Training Tasks

Of the 4 education and training tasks, the most frequently performed was "train laboratory staff" (88%), followed by "train non-laboratory staff" (54%). Most of the respondents never performed the remaining tasks "develop continuing education material" and "present continuing education material" (65% and 59%, respectively). See Figure 1.

Finance

The vast majority (86%–97%) of respondents indicated they never perform the 4 finance tasks. For these tasks, 14% of respondents indicated they often or sometimes "perform a cost analysis," 11% sometimes "determine productivity," 8% sometimes "negotiate vendor contracts," and 3% sometimes "prepare a laboratory/department budget." See Figure 1.

Human Resources

The HR tasks respondents most frequently performed (41% often or sometimes) were "evaluate employee performance" and "resolve conflict." The majority of respondents identified the remaining tasks, "interview applicants," "build employee consensus," "write job descriptions," and "hire new employees," as never being performed (73%, 82%, 92%, and 98%, respectively). See Figure 1.

Quality

The majority (50%–65%) of respondents indicated they often or sometimes perform all of the quality tasks with the exception of "perform a SWOT analysis" [strengths, weaknesses, opportunities, and threats analysis (SWOT)]; only 5% of respondents indicated they sometimes perform this task. See Figure 2.

Regulatory

The majority (57%–82%) of respondents indicated they often or sometimes perform all the regulatory tasks except for "develop/oversee document management/control system"; 46% indicated they perform this task often or sometimes. See Figure 2.

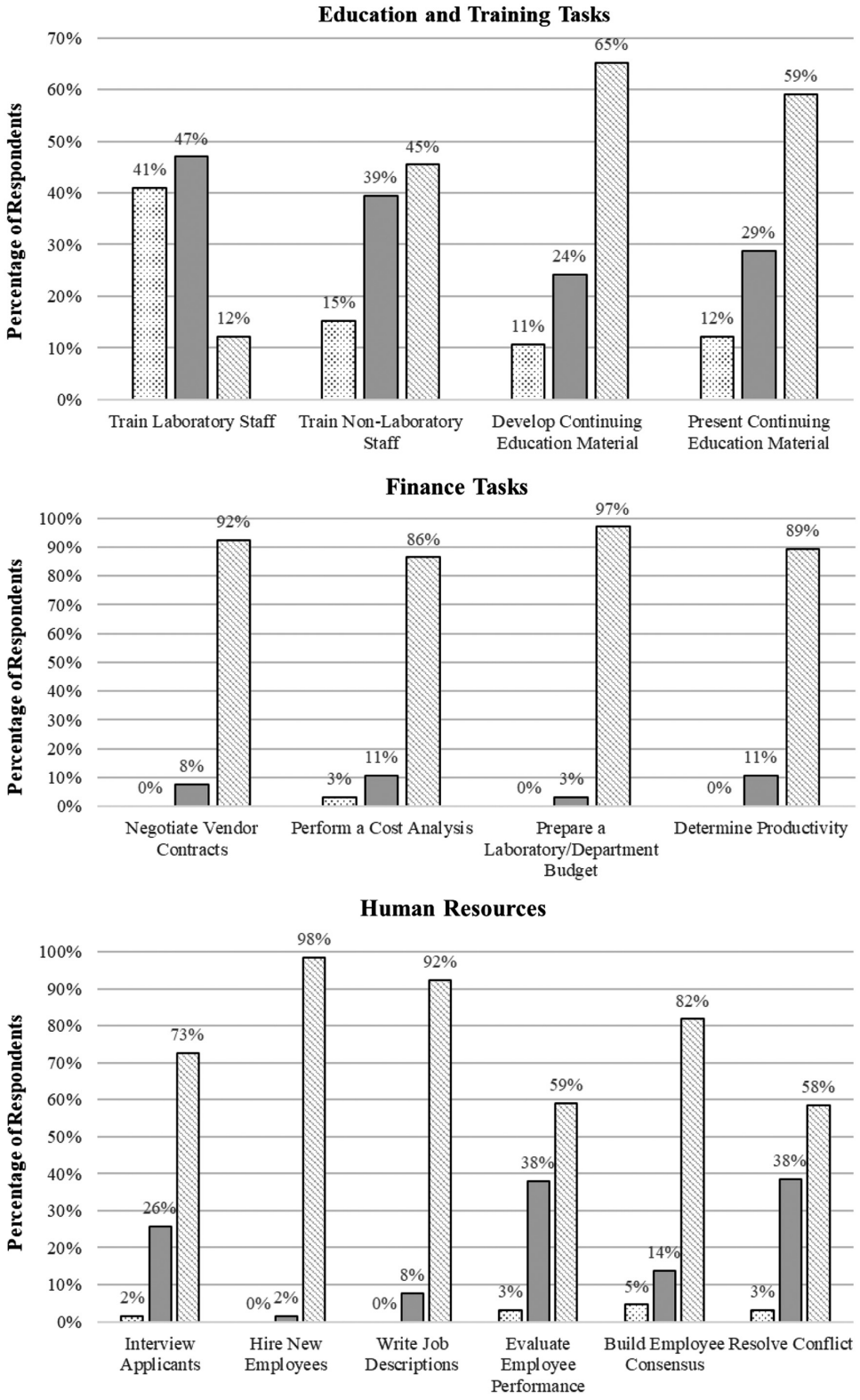

Figure 1. Managerial task performance (education and training, finance, and human resources).

Other Duties and Equipment Acquisition/ Validation

For this study, the tasks "recommend, select, and/ or acquire equipment" and "perform or participate in equipment/method validation" are considered equipment acquisition/validation tasks. The remaining 3 tasks are considered as other managerial duties.

The majority (53%–82%) of respondents indicated they often or sometimes perform all the other duties and equipment acquisition/validation tasks except for

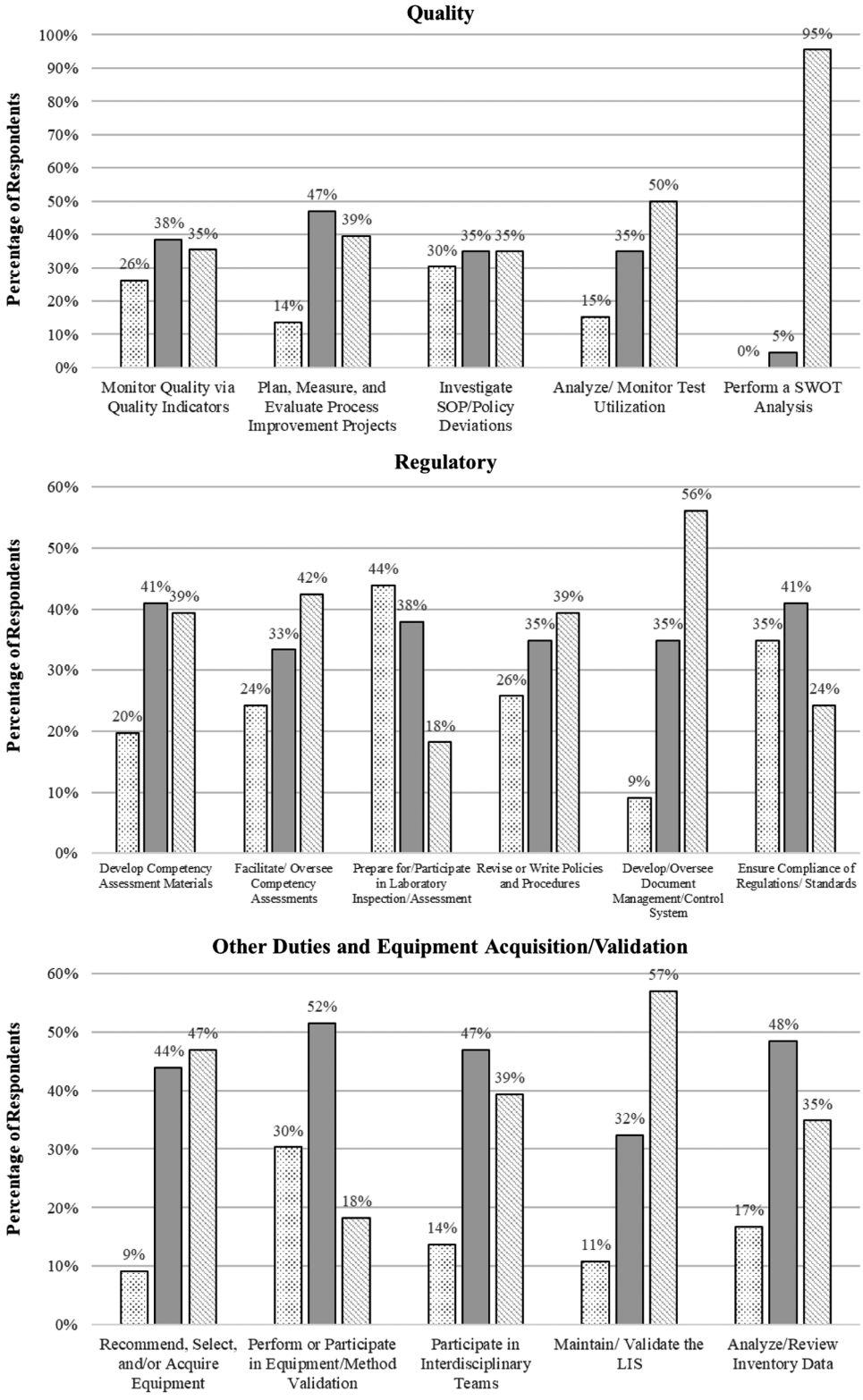

Figure 2. **Managerial task performance (quality, regulatory, and other duties and equipment acquisition/validation).**

"maintain/validate the LIS" [laboratory information system (LIS)]; 44% indicated they perform this task often or sometimes. See Figure 2.

DISCUSSION

Staff-level technologists frequently perform managerial tasks as part of their nonmanagerial job duties. Tasks

identified by the majority (≥50%) of respondents (self-reported) as being "frequently" performed included "train laboratory staff"; "train non-laboratory staff"; "monitor quality via quality indicators"; "plan, measure, and evaluate process improvement projects"; "investigate SOP/policy deviations" [standard operating procedure (SOP)]; "analyze/monitor test utilization"; "develop competency assessment materials"; "facilitate/oversee competency assessments"; "prepare for/participate in laboratory inspection/assessment"; "revise or write policies and procedures"; "ensure compliance of regulations/standards"; "recommend, select, and/or acquire equipment"; "perform or participate in equipment/method validation"; "participate in interdisciplinary teams"; and "analyze/review inventory data." Hence, familiarity with/preparation to perform these specific managerial tasks should theoretically occur prior to entrance into the MLS workforce (ie, during completion of an MLS educational program).

Curriculum Development

Developing the BS-level curriculum demands a balance between accreditation requirements and preparing learners for entry-level practice and beyond with the realistic expectations of how much learners can accomplish and comprehend in a 1-year program. Educators must also be visionary in anticipating how future entry-level practitioner skill requirements may evolve. The survey results will be utilized as one resource to develop inclusion/exclusion and cognitive level criteria for content in the management curriculum. See Table 2.

Education and Training

Based on the survey results, it is important to expose students to educational methodology because staff technologists are frequently involved in training. Additionally, NAACLS MLS standards require instructional areas to include "educational methodologies and terminology sufficient to train/educate users and providers of laboratory services." Therefore, at a minimum, students need practice applying these concepts. Currently, our BS-level students interpret/develop learning goals, objectives, and multiple-choice questions. In addition, they develop and present a continuing education-type session; however, the survey results indicate staff-level practitioners do not frequently perform these 2 tasks. Faculty are considering whether having students develop and teach a hands-on, laboratory session would be better preparation for entry-level practice. Formal presentation development and delivery would be master's level activities.

Finance

Per the survey results, staff technologists do not perform finance-related activities. Additionally, NAACLS MLS standard instructional areas do not specifically mention the term "finance." Therefore, only a brief introduction about laboratory finance, potentially with a greater focus on cost analysis, is adequate for baccalaureate-level MLS students. Negotiating vendor contracts and preparing a laboratory/departmental budget are out of the scope of practice for this practitioner level. The program anticipates the topics of cost analysis and productivity will continue to be introduced with knowledge-level activities. The master's curriculum will include graduate-level finance course(s).

Human Resources

Based on the survey results, an introduction to dealing with conflict in the workplace and how to objectively evaluate employee performance at a knowledge level may be beneficial to baccalaureate-level MLS students. Currently, the 2 aforementioned topics are not specifically mentioned in the NAACLS MLS standard instructional areas nor are they addressed in our program's baccalaureate management curriculum; students do, however, complete an exercise on conflict management style and are introduced to management problem-solving skills. Students also complete a group case study that requires them to apply basic problem solving to a laboratory HR situation. The remaining 4 tasks appear to be beyond the scope of practice of staff technologists, and, therefore, inclusion in a baccalaureate-level MLS program is not necessary. Although staff-level technologists do not routinely interview applicants, the faculty feel it is important to expose students to mock interview and application processes. The master's curriculum will include a graduate-level HR course focusing on effectively managing people.

Table 2. Curriculum inclusion guidelines

Content Areas With Tasks Performed Often/ Sometimes by the Following	Curriculum Inclusion Guidelines
>75% respondents	Application-level exercises
50%–75% respondents	Knowledge or application-level exercises
10%–50% respondents	Knowledge-level exercises
<10% respondents	Not included in BS-level curriculum unless mandated by accreditation

Quality

Per the survey, the tasks "monitor quality via quality indicators"; "investigate SOP/policy deviations"; "analyze/monitor test utilization"; and "plan, measure and evaluate process improvement projects" were performed by the majority of respondents. Additionally, NAACLS MLS standards require instructional areas to include "principles and practices of quality assurance/quality improvement." Therefore, these tasks should be included, at a minimum, at the knowledge level in the BS-level curriculum. "Performance of a SWOT analysis" is out of the scope of practice of staff technologists. Currently, baccalaureate-level students are introduced to test utilization, benchmarking, and root cause analysis at a knowledge level. Students also apply quality improvement principles to 1 mock laboratory-related scenario. Higher-level benchmarking and process improvement will be included in graduate-level management courses for the master's degree.

Regulatory

Per the survey, more than 75% of respondents frequently performed the tasks "prepare for/participate in laboratory inspection/assessment" and "ensure compliance of regulations/standards." Additionally, NAACLS MLS standards require instructional areas to include "application of safety and governmental regulations and standards as applied to clinical laboratory science." Therefore, these tasks should be included, at a minimum, at an application level in the BS-level curriculum. This program's current curriculum does not meet this cognitive level and needs to be taught at greater depth. The tasks "develop competency assessment materials," "facilitate/oversee competency assessment," and "revise or write policies and procedures" were performed frequently by 50%–75% of respondents and should be included, at a minimum, at the knowledge level. Although faculty do not feel BS-level practitioners are educationally prepared to develop competency materials for compliance purposes, they are being asked to do so. Perhaps compliance concepts do need to be taught in greater depth. Lastly, students are taught about the procedure revision process and complete an in-depth procedure validation assignment. Master's students will also write an entire procedure. "Document management/control systems" is out of the scope of practice of staff technologists and will only be addressed at the master's level.

Equipment Acquisition/Validation

Per the survey, more than 75% of respondents frequently "perform or participate in equipment/method validation." Therefore, this concept should be included, at a minimum, at an application level in the BS-level curriculum. Currently, baccalaureate-level students are taught in detail about the equipment/method validation process. For this topic, students complete a mock paper method validation with provided data; students are required to complete several in-depth exercises and write a paper summarizing the findings of the results. The task "recommend, select, and/or acquire equipment" was frequently performed by 50%–75% of respondents. Currently, students are introduced to these concepts at the knowledge level, which is appropriate based on the survey. For the master's level, we plan to investigate use of an application-level exercise for these concepts.

Other Duties

Per the survey, many respondents performed the tasks "analyze/review inventory data" and "participate in interdisciplinary teams." NAACLS MLS standards do not specifically mention the term "inventory data"; however, the standards do require instructional areas to include "communications sufficient to serve the needs of patients, the public and members of the health care team." Therefore, these tasks should be included, at a minimum, at a knowledge level in the BS-level curriculum. Currently, students are not taught about analyzing/reviewing inventory data. Because students in our program complete rotations in 20 different facilities, we have found it difficult to develop a standardized analysis/review of inventory data application exercise that is applicable to all laboratory contexts. Perhaps inventory analysis and review of knowledge concepts do need to be taught in the curriculum. Also, students are not formally taught about participating in interdisciplinary teams; however, they do learn about this topic by participating in interprofessional (ie, pharmacy, nursing, medicine, other allied health professions) education sessions. The remaining task, "maintain/validate the LIS," appears to be beyond the scope of practice of staff technologists, and NAACLS MLS standards instructional areas do not specifically mention the term "LIS." Therefore, inclusion in a BS-level MLS program is not necessary. For the master's level, we have decided not to include maintenance/validation of the LIS because the LIS varies by facility; hence, maintenance/validation would most likely be taught by the employing facility.

Limitations

The staff-practitioner cohort low response rate may limit data generalizability. The Midwestern MLS program that performed this study is using this data as one resource for management-related curricular decisions in a 3+1 MLS program. The discussion does not include consideration for 2+2 MLS programs. Because of the limited response rate, differences in task performance based on years of practice are not differentiated. A staff-level practitioner with 10 years of experience may have been given more opportunities to perform management-related tasks when compared with those with fewer years of practice.[7] Also, respondents' geographic location is not included.

Consequently, the survey does not measure differences in managerial skill performance based on geographical regions within the United States. In addition, the respondents' sense of educational preparedness in performing a specific task was not assessed. Lastly, differences in task performance opportunity are not differentiated based on type or size of clinical laboratory, gender, or highest level of education completed.

Future Research

Our findings suggest a need for further investigation into the level of self-reported and manager-reported preparedness of staff technologists for the managerial tasks performed by the majority of respondents. In addition, for master's level or advanced management course curriculum development, a need exists to determine the frequency of managers' performance of tasks that staff-level technologists do not perform. Lastly, at the national level, the researchers recommend exploring standardizing management-related terminology and content topics to help guide MLS educators' curriculum development.

REFERENCES

1. US Bureau of Labor Statistics. *Occupational Outlook Handbook, Medical and Clinical Laboratory Technologists and Technicians*. US Bureau of Labor Statistics; 2015. Updated December 17, 2015. Accessed October 21, 2016. http://www.bls.gov/ooh/healthcare/medical-and-clinical-laboratory-technologists-and-technicians.htm#tab-6.
2. Garcia E, Ali AM, Soles RM, Lewis DG. The American Society for Clinical Pathology's 2014 vacancy survey of medical laboratories in the United States. *Am J Clin Pathol*. 2015;144(3):432–443. doi: 10.1309/AJCPN7G0MXMSTXCD
3. NAACLS standards for accredited and approved programs. In: *MLS Curriculum Requirements*. National Accrediting Agency for Clinical Laboratory Sciences; 2016:14-15. Accessed October 20, 2014. http://www.naacls.org/getattachment/07662c8d-38ee-449a-a90f-9a7e8e8f5479/2012-Standards-Edited.aspx.
4. *Medical Laboratory Scientist, MLS(ASCP) International Medical Laboratory Scientist, MLS(ASCPi): Examination Content Guideline*. American Society for Clinical Pathology Board of Certification; 2014:4. Accessed October 20, 2016. https://www.ascp.org/content/docs/pdf/boc-pdfs/guidelines/examinationcontentguidelinemls.pdf?sfvrsn=6.
5. Riding K, Polancic J, eds. *ASCLS Entry Level Curriculum for Medical Laboratory Scientist (MLS) and Medical Laboratory Technician (MLT) Draft*. The American Society for Clinical Laboratory Science; 2016:10. Accessed online October 20, 2016. http://www.ascls.org/images/Leadership/delegates/House_of_Delegates_2016/HOD_Action_ELCProposed_20160730.pdf.
6. Beck SJ, Doig K. CLS competencies expected at entry-level and beyond. *Clin Lab Sci*. 2002;15(4):220–228. doi: 10.29074/ascls.15.4.220
7. Beck SJ, Briden MF, Epner PL. Practice levels and educational needs for clinical laboratory personnel. *Clin Lab Sci*. 2008;21(2):68–77. doi: 10.29074/ascls.21.2.68