

DEFINING DISCIPLINARY LITERACY PRACTICES AND EVALUATING THE
PROFESSIONAL IDENTITY OF MEDICAL LABORATORY SCIENCE

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PROFESSIONAL IDENTITY OF MEDICAL LABORATORY SCIENCE

By

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DEDICATION

For all the laboratorians – past, present, and future.

They are the hidden heroes of healthcare.

May a little light shine upon your good work.

ACKNOWLEDGMENTS

When embarking on this journey five years ago, I was both excited and nervous. Though I was looking forward to learning and expanding my knowledge about teaching and education, I was sure that I was going to be seen as an ‘outsider’ in relation to my classmates. With my degrees in medical laboratory science, only three years teaching in the medical laboratory science program, and with an ambiguous understanding of pedagogy, I was worried I would fall behind. However, my apprehension was unwarranted as the faculty and my fellow classmates embraced my perspectives as we all learned from each other and shared our strengths. That camaraderie among my classmates and the appreciation of different perspectives is a lesson that I will keep with me going forward.

I must thank the faculty that I work with in the medical laboratory science program. Without the support of Dr. Diane Davis and Meghan East – who have championed my research interests, listened to my frustrations, and encouraged and supported me as this dissertation project unfolded – I would not have been successful in completing this degree.

To my wonderful family, mere words are not enough to thank you for all the support you have shown me these last five years. I cannot thank my husband, Mike, enough for his quiet strength. From taking care of household chores, making meals when I was locked away writing, listening to my frustrations, and knowing when it was time for a break and treating me to a night out. Thank you. I am forever grateful for you.

I want to also acknowledge my parents, Tom and Mary Jo Gargan, my brother and niece, Patrick and Addison Gargan, and my in-laws, Bill and Vera Camillo. Between

my course work and the dissertation process over the last five years, I have had to either completely miss or only be partially present for many visits and family gatherings. You all have shown understanding and reassurance during this journey, and with that you have provided me with strength to continue.

Next, I would like to offer my appreciation for my dissertation committee. I would first like to thank Dr. Maida Finch for all of her insightful feedback, unwavering support, and gentle encouragement. She never had doubts, even when I did and I am so thankful for everything you have done to help me. Thank you, too to Dr. Laurie Andes, who had an eye for grammar and a knack for asking questions that helped to clarify the areas of my research that really needed more details. I am very appreciative of the assistance and insights I received when working with Dr. Melissa Bugdal, who has a wealth of knowledge about survey methods and a steadfast enthusiasm for research that was simply infectious. I am also grateful for the input and inspiration from Dr. Mary Ann McLane, whose perspective as an MLS educator was absolutely invaluable and much appreciated. Thank you for spending part of your retirement as a member of my committee! In addition, although he was not part of my committee, Dr. Jake Follmer not only taught me how to use Qualtrics, the platform used to distribute all of my surveys, but he was also instrumental in recommending the best way to analyze and interpret my survey data, and for that I am very grateful.

Finally, I would be remiss if I did not thank all the laboratorians who took time out of their busy schedules to participate in this research, whether they assisted with the cognitive interviews, contributed to the Delphi project as a member of the expert panel, or completed the MLS practitioner survey. Their generosity with their time was

humbling and their thoughtfulness was evident in the responses and comments I received. I hope that this project will not only draw attention to the medical laboratory science profession, but also open new areas for research among laboratory professionals. To my fellow medical laboratory science educators, I anticipate that this work will bring about a new way of thinking about how we teach our novice professionals. Those pre-professional students are the future of the profession, and it is up to us to make sure they are ready for their careers and be willing to stay on as valuable and knowledgeable members of the healthcare team. I embarked on this journey to better understand the profession and learn to be a more effective educator for future laboratorians. It is for them that I will continue to learn so that they can be successful in their careers.

ABSTRACT

Disciplinary literacy has been a growing area of interest in educational research (McConachie & Petrosky, 2010; Moje, 2007) in the last two decades, however much of the research has remained theoretical. While some studies have examined specific areas of disciplinary literacy, such as reading or writing, and compared that particular practice among different disciplines (Carter, 2007; C. Shanahan, Shanahan, & Misischia, 2011) very few studies have examined the entirety of the literacy of a discipline (Brill, Dohun, & Branch, 2007; Frick, 1990). This research study sought to define and understand the disciplinary literacy practices of medical laboratory science (MLS), an analytical and technical area of healthcare where professionals test patient samples in order to provide accurate data for physicians who are then able to diagnose the patient and provide effective treatment. In addition, this study investigated the professional identity of MLS, which has a long history of being indistinct and unorganized (Evans, 1968; Grant, 2007; Kotlarz, 1998a, 2000), and considered how the disciplinary literacy practices of the profession may contribute to a stronger professional identity.

In order to understand the disciplinary literacy practices used by members of the profession, MLS experts were recruited from the author's professional network and an MLS professional organization. These experts had ten or more years of experience in the profession and represented practitioners and educators, either active or recently retired. Using the consensus building method known as the Delphi method (Hasson, Keeney, & McKenna, 2000; Linstone & Turoff, 2002), these experts were surveyed three times. The first survey asked participants to identify the disciplinary literacy practices of MLS, encompassing reading, writing, and oral communication. The second survey presented

the identified practices back to the experts for their evaluation and level of agreement while the third survey clarified certain practices that did not reach consensus. A larger group of MLS practitioners evaluated the identified practices from the experts in order to enhance the trustworthiness of the findings. This group was also asked about professional identity. The majority of the disciplinary literacy practices reached consensus among the practitioners, though findings showed professional identity remains a concern for the profession.

Keywords: disciplinary literacy, professional identity, medical laboratory science, Delphi method

TABLE OF CONTENTS

	PAGE
DEDICATION	ii
ACKNOWLEDGMENTS	iii
ABSTRACT	vi
TABLE OF CONTENTS.....	viii
LIST OF TABLES	xviii
LIST OF ABBREVIATIONS / SYMBOLS.....	xxi
CHAPTER 1 INTRODUCTION	1
Problem of Practice.....	1
History of the MLS Profession.....	2
Current Issues in MLS.....	5
Motivation and Recognition.	6
Disciplinary Literacy and the MLS Profession	7
Discourse and the MLS Profession.	9
Disciplinary Literacy and Professional Identity.	10
Pilot Project Findings.....	13
Reading Practices of MLS	13
Read to Stay Informed.....	13
Read for Evaluation and Action	14

Read Multiple Semiotic Systems.....	14
Reading Practices Based on Role in the Profession	15
Writing Practices in MLS.....	15
Writing Inside of the Hospital	16
Writing Outside of the Hospital.....	16
Writing Multiple Semiotic Systems	17
Oral Communication in MLS.....	17
Between Coworkers.....	18
Between the Laboratory and Clinical Staff	18
Between the Laboratory and Others Associated with Healthcare	19
Between the Laboratory and Others Outside of Healthcare	19
Oral Communication Associated with Education	20
Overlap in Practices of the Discipline.....	20
Definitions.....	21
Conclusion	23
CHAPTER 2 REVIEW OF THE LITERATURE	25
Selection of Articles.....	26
Organization of the Review	27
Content Area Literacy and Disciplinary Literacy	29
Content Area Literacy	29

DEFINING DISCIPLINARY LITERACY PRACTICES OF MLS	x
MLS Content Knowledge and Content Area Literacy	30
Disciplinary Literacy.....	31
Postsecondary Disciplinary Education	36
Disciplinary Literacy of MLS.....	38
Defining a Discipline’s Literacy Practices.....	38
Discourse Theory	40
Text and Discourse.....	42
The Relationship between Discourse and Disciplinary Literacy	43
Implications for Research on Disciplinary Literacy	45
Professional Identity	46
Defining Profession.....	46
MLS as a Profession.....	47
Defining Professional Identity	49
The Professional Identity of MLS	50
The Importance of Professional Identity.....	51
Communities of Practice.....	54
The MLS Community of Practice	56
Professional Identity and Disciplinary Literacy	56
Conclusion	57
CHAPTER 3 METHODOLOGY	59

DEFINING DISCIPLINARY LITERACY PRACTICES OF MLS	xi
Description of the Delphi Method	59
Round One.....	60
Round Two.....	60
Round Three.....	60
Research Question	61
Researcher Positionality.....	63
Brief Description of the Pilot Project.....	64
Nomination of Experts	65
Expert Panel Participants.....	65
Current Study	66
Participants	67
MLS Experts Completing the Delphi Project.....	67
MLS Practitioners.....	68
Data Gathering and Analysis	71
Data Collection.....	71
Data Analysis	71
NVivo Analysis	72
Coding Methods.....	72
SPSS Analysis	73
Instrument Development.....	74

DEFINING DISCIPLINARY LITERACY PRACTICES OF MLS	xii
Round Three Instrument Development	74
MLS Practitioners Survey	75
Trustworthiness/Validity.....	76
Limitations	77
Ethical Considerations	79
Confidentiality.....	79
Conclusion	80
CHAPTER 4 RESULTS	82
Completion of Delphi Project with MLS Expert Panel	82
Round Two Data Analysis and Results.....	82
SPSS Analysis	82
NVivo Analysis	83
Coding Methods.....	83
Round Two Results	84
Disciplinary Literacy Practices That Reached Consensus.....	85
Disciplinary Literacy Practices Not Reaching Consensus.....	92
New Codes Developed from Round Two Data.....	93
Round Three Instrument Development.....	95
Clarifying Disciplinary Literacy Practices that did Not Reach Consensus.....	95
The Role of the MLS Professional and the Effect on Disciplinary Literacy Practices .	99

DEFINING DISCIPLINARY LITERACY PRACTICES OF MLS	xiii
New Disciplinary Literacy Practices.....	100
Importance and Frequency of Disciplinary Literacy Practices Reaching Consensus .	102
Round Three Data Analysis	103
SPSS Analysis.....	103
NVivo Analysis.....	104
Coding Methods	104
Partial Responses.....	106
Round Three Results.....	107
Clarifying Statements for Practices that did not Reach Consensus	107
New Disciplinary Literacy Practices to Understand	110
Understanding how the Role of the MLS Affects Disciplinary Literacy Practices	113
Importance and Frequency of Practices that Reached Consensus	115
Reading Practices that Reached Consensus.....	115
Writing Practices that Reached Consensus	119
Oral Communication Practices Reaching Consensus.....	123
Effect of Partial Responses	126
Conclusion	127
CHAPTER 5 RESULTS	129
MLS Practitioner Survey	129
MLS Practitioner Instrument Development.....	129

Questions from the Delphi Round Two Survey	129
Questions from the Delphi Round Three Survey	131
New Practices	131
Practices with Clarifying Statements.....	132
Questions Related to Professional Identity	133
Demographic Questions	133
Education and Certification	133
Institution Type and Location.....	134
Gender, Race, and Length of Time in Profession.....	134
Survey Design and Data Collection	135
Determination of Data for MLS Practitioner Survey Analysis.....	136
Removing Expert Responses.....	136
MLS Practitioners Survey Data Analysis	137
SPSS Analysis.....	138
Comparison of Experts and Practitioners.....	138
NVivo Analysis	139
Coding Methods	139
Results from MLS Practitioner Survey and Comparison to Expert Panel.....	141
Identified Disciplinary Literacy Practices.....	142
Reading Practices of MLS.....	142

Quantitative Analyses	145
Qualitative Analyses	147
Writing Practices of MLS	150
Quantitative Analyses	154
Qualitative Analyses	156
Oral Communication Practices of MLS	160
Quantitative Analyses	164
Qualitative Analyses	166
Effect of the Role of the MLS Professional in the Clinical Setting and Disciplinary Literacy Practices – Reading and Writing	178
Quantitative Analyses	180
Qualitative Analyses	181
MLS Practitioner Reading and Writing Experiences in Their Role	184
The Effect of the Role of the MLS Professional in the Clinical Setting and Disciplinary Literacy Practices – Oral Communication	188
Quantitative Analyses	190
Qualitative Analyses	190
MLS Practitioner Oral Communication Experiences in Their Role	193
Professional Identity among MLS Practitioners	197
Bivariate Analyses of Professional Identity	204

DEFINING DISCIPLINARY LITERACY PRACTICES OF MLS	xvi
Conclusion	209
CHAPTER 6 DISCUSSION AND IMPLICATIONS	211
Significance of the Study	211
Identified Disciplinary Literacy Practices of MLS	212
Reading Practices	212
Writing Practices	214
Oral Communication Practices.....	216
Multimodality of the Disciplinary Literacy of MLS	218
Implications and Recommendations	219
Disciplinary Literacy Practices and Discourse of MLS	219
Disciplinary Literacy Practices in the Clinical Setting.....	220
Disciplinary Literacy Practices in the Educational Setting	222
Research in Disciplinary Literacy	225
Professional Identity of MLS	226
Identified Practices with Opportunities for Professional Identity Development.....	227
Improving Professional Identity within the Healthcare Setting.....	228
Improving Professional Identity with the General Public.....	230
Improving Professional Identity with Legislators.....	231
Using Disciplinary Literacy to Promote Professional Identity.....	233
Limitations of the Study.....	233

DEFINING DISCIPLINARY LITERACY PRACTICES OF MLS	xvii
Future Research	235
Conclusion	239
References	242
APPENDICES	256
Appendix A – Delphi Project: Round Three Survey	257
Appendix B – MLS Practitioner Survey	274

LIST OF TABLES

	PAGE
Table 1. Description of MLS Expert Panel Participants for Round One, Round Two, and Round Three Data.....	66
Table 2. Description of MLS Practitioner Participants.....	69
Table 3. MLS Expert Panel Data Analysis. Round Two – Reading Practices that Reached Consensus, with Percent Agreement.....	86
Table 4. MLS Expert Panel Data Analysis. Round Two – Writing Practices that Reached Consensus, with Percent Agreement.....	88
Table 5. MLS Expert Panel Data Analysis. Round Two – Oral Communication Practices that Reached Consensus, with Percent Agreement.....	90
Table 6. MLS Expert Panel Data Analysis. Round Two – Disciplinary Literacy Practices that Did Not Reach Consensus, with Percent Agreement (Threshold for Consensus \geq 75%).....	92
Table 7. MLS Expert Panel Data Analysis. Round Three – Disciplinary Literacy Practices that Did Not Reach Consensus in Round Two, with Clarifying Statement and Percent Agreement (Threshold for Consensus \geq 75%).....	107
Table 8. MLS Expert Panel Data Analysis. Round Three – New Disciplinary Literacy Practices to Understand, with Percent Agreement (Threshold for Consensus \geq 75%)...	111
Table 9. MLS Expert Panel Data Analysis. Round Three – Disciplinary Literacy Practices as They Relate to the Role of the MLS Professional, with Percent Agreement (Threshold for Consensus \geq 75%).....	114

Table 10. MLS Expert Panel Data Analysis. Round Three – Reading Practices that Reached Consensus, Importance and Frequency Data.....	116
Table 11. MLS Expert Panel Data Analysis. Round Three – Writing Practices that Reached Consensus, Importance and Frequency Data.....	120
Table 12. MLS Expert Panel Data Analysis. Round Three – Oral Communication Practices that Reached Consensus, Importance and Frequency Data.....	123
Table 13. MLS Practitioner Data Analysis. Reading Practices of MLS – Level of Agreement (Expert Panel and MLS Practitioners) and Mean Deviation Score.....	142
Table 14. MLS Practitioner Data Analysis. Writing Practices of MLS – Level of Agreement (Expert Panel and MLS Practitioners) and Mean Deviation Score.....	151
Table 15. MLS Practitioner Data Analysis. Oral Communication Practices of MLS – Level of Agreement (Expert Panel and MLS Practitioners) and Mean Deviation Score.....	160
Table 16. MLS Practitioner Data Analysis. The Effect of the Role of the MLS Professional on Reading and Writing Practices – Level of Agreement (Expert Panel and MLS Practitioners) and Mean Deviation Score, Where Applicable.....	180
Table 17. Perceptions of MLS Practitioners of Their Reading and Writing Responsibilities Based on Job Category.....	186
Table 18. MLS Practitioner Data Analysis. The Effect of the Role of the MLS Professional on the Disciplinary Literacy Practices – Level of Agreement (Expert Panel and MLS Practitioners) and Mean Deviation Score, Where Applicable.....	189
Table 19. Perceptions of MLS Practitioners of Their Oral Communication Interactions Based on Job Category.....	195

Table 20. Perceptions of Professional Identity among MLS Practitioners – Level of Agreement.....	198
Table 21. Correlation Values using Spearman’s rho – MLS Practitioners’ Perceptions of Being Treated as a Professional.....	205
Table 22. Correlation Values using Spearman’s rho – MLS Practitioners’ Perceptions of Professional Organizations and Continuing Education.....	206
Table 23. Correlation Values using Spearman’s rho – MLS Practitioners’ Perceptions of Teaching Students and Other Healthcare Professionals.....	207
Table 24. Correlation Values using Spearman’s rho – MLS Practitioners’ Perceptions of Being Proud of the Work They Do as a Member of the Profession.....	208

LIST OF ABBREVIATIONS / SYMBOLS

AAB	American Association of Bioanalysts
AMT	American Medical Technologists
ASCLS	American Society for Clinical Laboratory Science
ASCP	American Society for Clinical Pathology
BOC	Board of Certification (previously BOR)
BOR	Board of Registry
CDC	Centers for Disease Control and Prevention
CE	Continuing Education
CLIA	Clinical Laboratory Improvement Amendments of 1988
CLS	Clinical Laboratory Science / Clinical Laboratory Scientist
CMS	Centers for Medicare and Medicaid Services
DCLS	Doctor of Clinical Laboratory Science
DHHS	U.S. Department of Health and Human Services
LIS	Laboratory Information System
MLS	Medical Laboratory Science / Medical Laboratory Scientist
MLT	Medical Laboratory Technician
MT	Medical Technologist (now MLS)
SOP	Standard Operating Procedure
STEM	Science, Technology, Engineering, Math
TAT	Turnaround Times

CHAPTER 1

INTRODUCTION

Problem of Practice

There are many professions that make up the healthcare team; the most easily recognized are physicians and nurses. However, there are many other occupations that are critical for patient diagnosis, care, and treatment, though they are less well known. One such discipline is Medical Laboratory Science (MLS), which is a highly technical and specialized field in healthcare. This profession has very specific content knowledge related to analytical examination and testing of patient samples, and the information is periodically updated to keep up with the constant changes in medicine (ASCLS, 2015). While the content knowledge required of MLS professionals is a very important part of the discipline, there are also unique social norms and practices for communicating information within the profession and to others outside of the profession (Z. H. Fang & Coatoam, 2013; C. Shanahan et al., 2011). These distinctive communication norms for MLS represent the discipline's specific literacy practices.

Disciplinary literacy has become an area of focus for literacy researchers in the last two decades (McConachie & Petrosky, 2010; Moje, 2007) and represents a departure from the more established concept of content area literacy (Z. H. Fang & Coatoam, 2013; Hynd-Shanahan, 2013; C. Shanahan & Shanahan, 2014). Where proponents of content area literacy believe reading and writing are a set of skills that can be applied to any educational area or discipline (T. Shanahan & Shanahan, 2012), disciplinary literacy considers the specific and unique ways that experts in a field read, write, and communicate (Z. H. Fang & Coatoam, 2013; Hynd-Shanahan, 2013; McConachie &

Petrosky, 2010). Theorists believe students who learn the disciplinary literacy practices are better able to engage with the material and are motivated to learn the discipline (Moje, 2007), although these practices are often implicit and learned indirectly (C. Shanahan & Shanahan, 2014). Though content area knowledge, and therefore content area literacy, is very important for MLS students and professionals to know and understand, the disciplinary literacy practices of the profession are equally valuable in order to effectively apprentice students into their chosen profession. Though the research into disciplinary literacy has grown, particularly in the four core academic subjects of English, social studies, mathematics, and the natural sciences (Moje, 2007), there have been no research studies examining the unique disciplinary literacy of the highly specialized healthcare profession of MLS.

The intent of this research study is to determine the particular disciplinary literacy practices that are part of MLS. In addition, I hope to understand how the profession's disciplinary literacy practices relate to and affect the professional identity of MLS professionals. This study continues research that was conducted as part of a previous pilot study (Camillo, 2018). The pilot study used a mixed-methods approach, known as the Delphi method, and began the consensus-building process with a panel of experts to define the disciplinary literacy practices of MLS (Camillo, 2018).

History of the MLS Profession

The MLS profession began early in the 1900s, when there were outbreaks of disease that prompted public health departments and hospitals to hire bacteriologists to test samples and identify these diseases, but few were qualified to do this work (Kotlarz, 1998e). Advancement opportunities were limited and wages were low; as a result, men

generally avoided this line of work and instead these positions were considered a job for women (Kotlarz, 1998e). Eventually clinical pathologists, who had been performing laboratory tests themselves, determined that they could train a laboratory technician to perform simple testing. This allowed the pathologists time to pursue other areas of interest and professional advancement (Kotlarz, 1998e).

A severe shortage of laboratory help after World War II prompted a push by the pathologists to create standardized education and to certify reliable laboratory technicians, now known as MLS professionals (Kotlarz, 1998c). The creation of the Board of Registry (BOR) by the American Society for Clinical Pathology (ASCP) marked the official establishment of the profession (Kotlarz, 1998c). Throughout the years, there have been rival organizations and divisions of the profession into different education levels and specialties (Kotlarz, 1999b, 1999c). These divisions have detracted from a cohesive identity among professionals in the discipline (Kotlarz, 2000), and paternalistic views of some pathologists and the ASCP continue to hold back the profession as a whole (Kotlarz, 1998a, 2000).

This lack of a professional identity has led to some serious problems related to recognition of the MLS profession among others in healthcare and the general public, and there has been a history of poor recruitment and retention of employees, particularly those who are new to the profession (Butina & Schell, 2011; Kotlarz, 2001; Schill, 2017). Within the MLS professional community, it is recognized that the laboratory is often overlooked as a part of the healthcare team (Kotlarz, 2000). As a result, in 2005 ASCLS drafted a position paper outlining the value of MLS professionals (ASCLS, 2005). This document supported the organization's position that laboratory professionals provide a

vital service by delivering high quality, evidence-based results and information to physicians that directly impacts patient care (ASCLS, 2005). However, a recent example of the effect of not having an established professional identity relates to a 2016 decision made by the Centers for Medicare and Medicaid Services (CMS). This decision maintained that someone with a nursing degree has the appropriate knowledge and skills to perform high-complexity testing in a laboratory (CMS, 2016). Although nursing professionals have many important talents and are vital members of the healthcare team, their formal training includes very little, if any, clinical laboratory education.

To contextualize what high-complexity testing involves, the Clinical Laboratory Improvement Amendments (CLIA) of 1988 must be referenced. CLIA set standards for laboratories and, in part, defined categories of laboratory testing from waived to high-complexity testing. Waived testing involves “simple tests with a low risk for an incorrect result” (CDC), and includes home test kits, glucometers, and many patient bedside testing methods. Non-waived testing includes moderate- and high-complexity test methods and are determined based on seven measures;

a) degree of knowledge needed to perform the test; b) training and experience required; c) complexity of reagent and materials preparation; d) characteristics of operational steps; e) characteristics and availability of calibration, quality control, and proficiency testing materials; f) troubleshooting and maintenance required; and g) degree of interpretation and judgment required in the testing process. Must meet requirements for proficiency testing, patient test management, quality control, quality assurance, and personnel (CDC, 1992)

While waived testing is relatively simple to perform and provides results that are easy to interpret according to CLIA, high-complexity tests require a deeper understanding about the test methodology. Interpretation of test results from high-complexity methods is often nuanced, requiring experience and a more detailed analysis, to include the ability to

recognize when the test is not working appropriately and providing inaccurate results.

These high-complexity tests also require confirmation that the test systems are working correctly through quality control verification. Those who work with these complex test methods must have the ability to evaluate problems and find solutions so that these test systems provide reliable and accurate test results.

The educational requirements of pre-professional MLS students and the training that happens in the workplace prepares MLS professionals to be able to perform and evaluate these high-complexity tests. In contrast, nursing professionals have little, if any, training in laboratory methods and their education focuses on other important concepts related to patient care. There were efforts by representatives of the American Society for Clinical Laboratory Science (ASCLS) to change the decision by CMS on the qualifications for performing high-complexity testing (ASCLS, 2018b, 2018c), but CMS maintained their position that nurses are qualified to perform these laboratory tests.

Current Issues in MLS. One of the most pressing concerns for the MLS profession is the ongoing shortage of laboratory professionals (Funnys-Doby, 2016; Rothenberg, 2017), and this issue has been highlighted in a recent position paper from ASCLS (2018a). This has been a concern almost since the beginning of the profession (Kotlarz, 1998e). Even more troubling, the average age of practicing professionals is nearing retirement age, meaning there will be an exponential increase in the shortage in the coming years (ASCLS, 2018a; Beck & Doig, 2005; Doig & Beck, 2005; Funnys-Doby, 2016; Rothenberg, 2017). In addition to recruiting individuals into the profession, retaining novice and early-career professionals has become a challenge (Beck & Doig, 2005; Funnys-Doby, 2016; Rothenberg, 2017). Reasons for leaving the profession can

vary, but often relate to salary concerns, difficult schedules that require the laboratory to be staffed all day and night, high-stress environments due to the fast pace and quick turn-around times, and a lack of motivation and recognition (ASCLS, 2018a; Funnye-Doby, 2016; Rothenberg, 2017).

Furthermore, over the last several decades, many MLS programs have closed, decreasing the number of potential graduates to join the workforce (Beck & Doig, 2007; Butina & Schell, 2011; Funnye-Doby, 2016; Rothenberg, 2017). The remaining MLS programs cannot keep up with the current demand; even if these schools had full classes and graduated all of their students, they would still not meet the need for laboratory personnel (Beck & Doig, 2005; Rothenberg, 2017). Because of this shortage of students, retaining professionals who are already working has been a focus of research for the MLS profession. Primary issues for retention relate to salaries, scheduling, having enough staff to work, and having management that is responsive to the employees (Beck & Doig, 2005; Funnye-Doby, 2016; Rothenberg, 2017).

Motivation and Recognition. Research conducted by Beck and Doig (2005) asked laboratory managers to indicate factors that had a significant influence on retention of employees. These authors determined that salary and benefits were the highest rated factors but if salary was addressed adequately, motivation and recognition became important for retaining employees. The managers indicated that giving positive feedback and recognition to employees was important, as well as “[r]ecognition and respect from nursing, administration, pathologists, and the public” (Beck & Doig, 2005, p.243). In addition, the managers felt that allowing laboratory professionals to participate in projects and make decisions that affect their daily work, along with providing opportunities for

the employees to have higher responsibilities, had an influence on retention. Efforts to retain employees, particularly within the first five years, are critical in maintaining the needed workforce (Beck & Doig, 2005; Funnye-Doby, 2016). These researchers have found that graduates are prepared and willing to stay so long as they receive adequate compensation, feel the work is interesting, and have opportunities to advance (Beck & Doig, 2007).

The ASCLS position paper highlighting the value that MLS professionals have as part of the healthcare team (ASCLS, 2005) represents a good foundation for enhancing the MLS professional identity, but there are other attributes of the profession that might offer new ways to enrich the identity of MLS professionals. Identifying and defining the disciplinary literacy practices of MLS could lead to a fresh perspective on the profession and how the community is interconnected with each other and the healthcare team. This knowledge will provide an opportunity for MLS professionals to embrace and promote our knowledge and expertise in healthcare. It may also present avenues for recruiting new MLS students and for finding innovative ways to retain new employees in the profession.

Disciplinary Literacy and the MLS Profession

The disciplinary literacy of MLS comprises the technical vocabulary, the way in which reading and writing are used in the profession, and how MLS professionals communicate. Communication in the MLS profession is very important and the primary exchange involves conveying test results to a patient's healthcare provider (Conway-Klaassen et al., 2015). Forsman (1996) suggested that "...although the laboratory represents a small percentage of medical center costs, it leverages 60-70% of all critical

decisions, e.g., admission, discharge, and drug therapy” (p.813). Although these values were initially deemed anecdotes by the author (Forsman, 1996), and others have offered some criticism as to the validity of the author’s claims (Hallworth, 2011), it remains true that MLS professionals must be able to communicate patient test results efficiently and clearly to other members of the healthcare team. Additionally, how MLS professionals communicate to each other in a professional setting, whether it is within the clinical setting or through professional organizations, is important to understand. MLS professionals are often required to write procedures and protocols so that others can accurately and consistently conduct testing on samples. These are typically based on the manufacturer’s product insert for the test or reagent and these documents may also include important details about entering values into the laboratory information system (LIS) which transfers the results to the patient’s healthcare record. Furthermore, MLS professionals can be involved with research into new test methods to determine their effectiveness and accuracy, and they may be called upon to conduct cost analyses.

Along with their regularly assigned duties, MLS professionals are often required to teach pre-professional MLS students attending clinical internships. These internships are essential for these students, as the MLS professionals apprentice the students into the discipline’s literacy practices, to include those that are implicit and learned through experience (C. Shanahan & Shanahan, 2014). However, this additional duty often does not come with any compensation and there is typically no formal training for MLS professionals who take on the responsibility of teaching students (Kotlarz, 1999a; Miller, 2014). As a result, some MLS professionals who are in this position may not understand the vital role they play in educating new members of the discipline. Additionally,

because the profession is not readily recognized by the general public, communication with others outside of the profession can be crucial not only for public education but also for recruitment of new students (Kotlarz, 2000). Though they are often implicit, MLS professionals must have a good understanding of the literacy practices of the discipline, as they are a key part of performing the job.

Discourse and the MLS Profession. Another area of educational research that is related to disciplinary literacy is that of Discourse theory, developed by James Paul Gee (Gee, 2015b). This theory evolved from sociocultural concepts of learning and language. Gee (2014) described a small “d” discourse as actual language that is being used in a particular context, which can then be analyzed through discourse analysis. However, small ‘d’ discourse represents one element of Gee’s concept of a big “D” Discourse (Gee, 2014, 2015b). A Discourse goes beyond language shared in a particular context, whether in conversation involving speaking and listening or an interaction between reader and writer, and includes how individuals act, dress, feel, think, and interact (Gee, 2015b). Discourses are socially constructed and individuals can be identified as being part of a particular Discourse by the language they use and how they behave and express themselves, thus signaling that they are part of that Discourse and are recognized as such (Gee, 2015b; Unrau & Alvermann, 2013). An individual can be part of many different Discourses. As with any socially constructed institution, the MLS profession qualifies as a Discourse. The profession has characteristic ways of dressing, actions that occur in the laboratory setting, values and norms, and discourses among other MLS professionals and others in healthcare.

Socialization into a Discourse happens both with explicit teaching and acquisition, or observation, of the norms associated with that Discourse (Gee, 2015b). Gee (2015b) argues that “Discourses are mastered through acquisition, not learning” (p.190). So while there is content knowledge associated with a Discourse that is important for those in the Discourse to know, there are also social norms, values, and ways of being associated with the Discourse that cannot be taught directly (Gee, 2015b). Disciplinary literacy represents a particular area of the Discourse that is often implicit within the discipline (C. Shanahan & Shanahan, 2014). Experienced MLS professionals are key to apprenticing new professionals into the Discourse and the disciplinary literacy practices of MLS.

Disciplinary Literacy and Professional Identity. It is likely that the disciplinary literacy practices of MLS will be highly associated with the profession’s identity, though historically the professional identity of MLS has not been well defined and has even been constrained (Evans, 1968; Grant, 2007; Kotlarz, 1999b, 2000). In the early years of the MLS profession, pathologists outlined a strict code of ethics that forbade laboratory professionals from diagnosing a condition or advising physicians, and the management of the laboratory and teaching students could only be performed under a pathologist’s supervision (Kotlarz, 1998a). Though this code of ethics is no longer part of the profession, more recent changes in healthcare focus on decreasing costs (Horn, Koplan, Senese, Orav, & Sequist, 2014) and laboratories are often merged or decentralized. This consolidation “may undermine the influence of laboratory professionals, isolating them from clinical problems and leading to some degree of

‘deprofessionalisation’” (Ferraro et al., 2016, p.2). Unfortunately this has a negative effect on the professional identity of MLS. As Ferraro et al. (2016) point out:

It is noteworthy that there is a certain reluctance by laboratory professionals to engage themselves in test structuring and requesting as well as in the inspection of work as it arrives because it is assumed that all requests by clinicians are necessary. (p.8)

This finding is, perhaps, unsurprising given that there has always been resistance in allowing laboratory professionals to interpret test results and assist in making diagnostic decisions. Although medical laboratory scientists have the training and knowledge to make decisions related to further analyses that could assist with patient care, laboratory professionals have historically been discouraged from participating in this area of healthcare (Kotlarz, 1998a, 1998b). The code of ethics for medical technologists established in 1926 by the BOR specified deference to physicians and pathologists such that laboratory professionals could not interpret tests or make recommendations for diagnosing a patient’s medical condition, unless the result of the laboratory testing provided indisputable evidence for a health concern (Kotlarz, 1998c).

However, it is important to note that research and new advancements in medicine are constantly increasing the amount of knowledge for all healthcare providers (Stead, Searle, Fessler, Smith, & Shortliffe, 2011) and that medicine is moving toward professionals who are specialists in particular areas (Kotlarz, 1998d). This increasing amount of knowledge becomes difficult for any one member of the healthcare team to know (Ferraro, Braga, & Panteghini, 2016; Stead et al., 2011). As Stead et al. (2011) state, “the explosive growth of biomedical complexity calls for a shift in the paradigm of medical decision making—from a focus on the power of an individual brain to the collective power of systems of brains” (p.429). This same sentiment was expressed in

1944 by Dr. Kano Ikeda when he indicated that "...[i]t had become impossible for a single individual, regardless of training, to master all areas of medical practice" (Kotlarz, 1998c, p.340). MLS professionals have detailed knowledge of laboratory testing, including specific information related to test methodologies, new testing methods, and costs. Therefore, laboratorians are an important resource for clinicians in understanding what the results mean, how reliable the test methods are, and in helping to reduce unnecessary testing (Ferraro et al., 2016). Interestingly, although there are currently efforts to reduce unnecessary testing and promote evidence-based laboratory testing practices (ABIM, 2019a), only the professional society representing pathologists is listed as a society partner for the project, while the laboratory professional society is not (ABIM, 2019b).

Those who practice in this specialized field in healthcare have expertise and knowledge that is unique in healthcare as a whole, though their importance is often not recognized (Ferraro et al., 2016), even to themselves. MLS professionals are on the front lines of learning and testing new diagnostic technologies, monitoring the changing resistance patterns of bacterial diseases, and providing timely and accurate laboratory results that are critical to effective patient care. Defining the disciplinary literacy practices of MLS could offer new ways to characterize the profession. In addition, understanding the disciplinary literacy and Discourse of MLS could help to redefine the professional identity of MLS, leading to some much needed recognition as important members of the healthcare team. As recognition has been identified as a contributing factor for retaining employees in the field (Doig & Beck, 2005), this research could offer

new opportunities for retaining MLS professionals and help stem the ongoing shortage of laboratory personnel (Butina & Schell, 2011).

Pilot Project Findings

The current study continues research that was conducted as part of a pilot project that began the process of defining the disciplinary literacy practices of MLS (Camillo, 2018). The three areas of consideration for defining the literacy of a discipline are reading, writing, and oral communication practices. The pilot project, which encompassed the first part of the research method known as the Delphi method, sought input from a panel of experts and examined each of the three areas associated with disciplinary literacy. The findings related to each area are presented briefly.

Reading Practices of MLS

Three primary practices related to reading were identified; MLS professionals read to stay informed, for evaluation and action, and they also read multiple systems that do not require written words (semiotics). Reading practices also vary based on the role of MLS professional in the laboratory setting. Each of these areas are addressed and defined below.

Read to Stay Informed. 65% of the experts suggested that reading practices in MLS involve staying informed about advances in technology and medicine, which is also useful in teaching pre-professional MLS students. These practices also include reading to solve a problem, which leads to knowledge about resolving the problem in the future. Participants identified a variety of resources that are used, including professional journals, textbooks, technical manuals, newsletters, and online resources. Keeping informed is vital so that the MLS professional stays current in medicine and provides

accurate test results for patients. It is also an important part of recertification, as continuing education is required for MLS professionals to maintain their certification.

Read for Evaluation and Action. MLS professionals are tasked with reading instructions, Standard Operating Procedures (SOP), instrument information, quality control, and patient results and 92% of the experts identified this type of practice as being important for MLS professionals. Once the information is read, laboratory professionals must perform some kind of action, such as following the SOP to accurately perform the test method or reporting the quality control or patient results. Participants indicated that interpretation of quality control results is critical for patient care in order to make sure that results provided by a test system are accurate. If this is not checked, patient care could be adversely affected. The MLS professional must also be able to determine if follow up procedures should occur based on the patient results, such as additional testing, dilutions, or other sample manipulations that will provide accurate results. This ability to evaluate and act appropriately is critical to providing quality patient care.

Read Multiple Semiotic Systems. Reading practices in the laboratory go beyond reading written words and 65% of the experts identified some aspect of these varied systems in their responses. Multiple semiotic systems were presented by the participants and are used in the laboratory for a variety of reasons, from numeric output of patient results, to visual representations of data or test systems, to auditory input. Each of these has a particular purpose that plays an important role in the efficient operation of the laboratory for providing accurate patient results. These specialized reading and interpretation practices are part of the professional Discourse and social language (Gee, 2013b) of the MLS discipline.

Reading Practices Based on Role in the Profession. 12% of the MLS experts indicated that specific reading practices performed by a MLS professional may be different based on the role that the professional has in the hospital. Managers read different types of documents compared to bench MLS professionals. For instance, managers examine budgets and personnel documents, while bench MLS professionals mostly focus on SOPs and running testing every day. These differences reflect the daily activities and responsibilities for the different professional roles in the laboratory. This demonstrates the varied social languages (Gee, 2013b) that are dependent on the role or identity of the professional within the overall Discourse of MLS.

These results can be related to the concept of Discourse and social language (Gee, 2013a) associated with a particular profession, in this case MLS. The MLS discipline has particular ways of reading that translate into activities that are performed and an identity for the MLS professional, which is familiar to those who are part of the Discourse (Gee, 2013b).

Writing Practices in MLS

Three main writing practices became evident from the data. Two of these practices focused on the audience for the writing, specifically whether the audience was inside or outside of the hospital. Inside of the hospital, clinicians, nurses, and other MLS professionals focus on patient care and daily activities. Outside of the hospital, writing practices focused on education, as well as government and accrediting agencies. As with reading practices, the MLS expert panel indicated that writing not only applied to written words, but also other semiotic systems. This connection between multimodal sign systems as they relate to both reading and writing shows how complex the language

system is (Goodman, Fries, & Strauss, 2016) related to MLS. Each identified practice is addressed below.

Writing Inside of the Hospital. According to over 95% of the members of the expert panel, there are a variety of important writing practices that take place in a clinical setting. Patient result reporting is one of the primary writing practices that was recognized and an accurate, well-written SOP should be followed in order to get quality patient results. MLS professionals are required to document many different tasks during a day and they must communicate effectively with other personnel to maintain a continuity of service from shift to shift. At the supervisory level, writing practices are more varied, and include budgets, personnel matters, SOPs, and evaluating daily activities and operations of the laboratory. This written social language (Gee, 2013b) is a major part of the Discourse of MLS and critical to maintaining the daily activities in the laboratory and for quality patient care.

Writing Outside of the Hospital. Although the primary writing practices for the MLS professional have to do with writing in the clinical setting, 36% of the MLS experts identified a variety of writing practices that are performed for an audience that is outside of the hospital. These writing practices may include the production of continuing education documents focused on current MLS professionals, educational presentations for pre-professional MLS students, and regulatory and accreditation documentation necessary for keeping the laboratory operational. They were cited as being important for participating in the advancement of the profession and ensuring that the clinical laboratory remains in compliance.

Writing Multiple Semiotic Systems. In the same way that MLS professionals read multiple sign systems that do not use written words, they must also produce information that does not include written words. 44% of the MLS experts identified this practice in their responses. The systems include numeric values, charts and graphs that provide important information to the MLS professional, and images and videos to share information with students and other professionals.

The results from the pilot project showed that writing practices in MLS are primarily focused on the audience and the purpose of the writing. The role of the MLS professional in the laboratory also determines the type of writing practices they use. Gee (2013b) might suggest that the hospital or clinical setting is the primary audience that MLS professionals encounter every day, and the social language of that community of practice makes up the Discourse of the profession. Outside of the clinical setting, writing practices are modified for other audiences made up of different Discourses (Gee, 2013b) and the MLS professional must navigate those different Discourses. As with reading practices, writing practices in MLS may include images, videos, tables, charts, and other semiotic systems to convey information, demonstrating the complexity of the language system (Goodman et al., 2016) of MLS.

Oral Communication in MLS

Oral communication practices in MLS serve a variety of purposes but the MLS expert panel suggested these practices are very different depending on the role of the individual who is being addressed, such as coworkers, clinical staff, those ancillary to healthcare, those outside of healthcare, and when educating healthcare professionals and

pre-professional MLS students. Each requires different types of oral communication practices and will be addressed below.

Between Coworkers. The majority of the oral communication practices that occur for MLS professionals happens between coworkers in the laboratory, and 83% of the MLS experts expressed some aspect of this in their responses. One of the primary practices acknowledged the communication required in order to maintain a continuity of service between shifts. Coworkers will also discuss instrument or reagent problems or inform coworkers about the status of reagents or instruments. There are oral communication practices related to discussing anomalous patient test values in order to provide the most reliable results to clinicians. Moreover, MLS professionals also teach new or current employees and students using oral communication, and there are communication practices that occur that are designed to share information between bench MLS professionals and supervisors. Each of these practices represents part of the social language of MLS and contributes to the Discourse (Gee, 2013a) of the profession.

Between the Laboratory and Clinical Staff. The primary job of the MLS professional is to provide patient results to clinical staff so they are able to deliver quality care to the patient. When examining the responses from the MLS expert panel, it became apparent that most of the communication between the laboratory and clinical staff falls into two broad categories: Practices to convey information or to answer questions. 91% of the MLS experts expressed these forms of oral communication in their responses. Both of these practices are focused on patient care and understanding what the clinical staff has requested from the laboratory staff, making inquiries into a patient's health

history, and communicating patient results in order to provide the best possible service to the clinical staff and quality care for the patient.

Between the Laboratory and Others Associated with Healthcare. In healthcare, there are more than just doctors and nurses associated with hospitals. Administrators, environmental or janitorial staff, couriers and delivery personnel, and individuals who maintain and repair laboratory instruments are all associated with hospitals and, consequently, contribute to the communication practices of the laboratory. 43% of the MLS expert panel presented examples of oral communication practices associated with ancillary healthcare workers. Oral communication with these individuals is important for keeping the environment safe and clean and for purchasing and maintaining laboratory instruments. In addition, couriers provide samples from off-site facilities, delivery personnel provide supplies that are important and keep the laboratory operating appropriately, and the administration makes sure that laboratory operations are functioning well and following all appropriate policies and regulations while staying within the allotted budget.

Between the Laboratory and Others Outside of Healthcare. 25% of the MLS expert panel indicated that oral communication with those entirely outside of healthcare is not very common. Although rare, there are some practices highlighted by participants that were mainly divided into communication with patients and communication with others, such as government officials, blood donors, community members, and the general public. Though these oral communication practices are not typical, they are important for providing patients and donors with accurate information, whether it relates to proper preparation for their laboratory tests or for donating blood. Also important are

communication practices that promote the profession to the general public, potential students, and legislators.

Oral Communication Associated with Education. Approximately 33% of the expert panel presented communication practices associated with educating both healthcare professionals as well as pre-professional MLS students. These practices have to do with communication for continuing education, both for MLS professionals and others associated with healthcare. Oral communication practices that relate to teaching MLS students were also presented.

Findings from the pilot project show that oral communication practices are associated with the audience. Gee (2013b) might suggest that these practices represent a part of the social language and overall Discourse of MLS. There are other communities of practice associated with the clinical setting as well as in education, and there are particular social languages that facilitate communication between these communities and MLS. In each case, the Discourse (Gee, 2013b) associated with the laboratory is specific and unique in healthcare.

Overlap in Practices of the Discipline

In some cases, there was overlap in the responses provided by the MLS expert panel as they related to particular practices. This was evident in each of the three areas: reading, writing, and oral communication. For example, critical results have to be read and interpreted by the MLS professional first. Once understood, the results are then called and orally communicated to the provider. After verbal confirmation, the results must also be written and documented. Another example relates to SOPs where writing a clear and understandable SOP is vital so that all MLS professionals can follow each step

accurately and efficiently in order to provide the correct patient results. Taking the time to read the SOPs and follow each step correctly is also important, again so that patient results are reliable.

Definitions

The following definitions are relevant to this study:

Bench tech / Bench MLS professional – an MLS whose primary job is to test patient samples that are brought into a hospital or other clinical laboratory setting, report results, maintain instruments, and perform quality control testing.

Clinical Coordinator – typically an MLS working in either a clinical or academic setting who manages students who are attending clinical internships. In a clinical setting, students are attending at a specific clinical site and the clinical coordinator on site manages and monitors the students' progress. In the academic setting, the clinical coordinator may manage multiple clinical sites by securing clinical internship spots for students and monitor students' progress throughout the various internships and sites.

Consultant – an MLS could work in a wide variety of consultancy positions and these may include consulting for small physician's office laboratories, infectious disease monitoring, education module development, quality control and quality management system, laboratory design, Lean Six Sigma method, and more.

Educator / Instructor – an MLS who is working in either an academic setting or in a clinical setting with a focus on education. In an academic setting, this would involve teaching didactic coursework to students attending an MLS program. In the clinical setting, it would involve teaching students during their clinical internships for MLS, but may also include students from other disciplines, such as medical or nursing students.

Lead MLS Professional – typically an MLS achieves Lead status after several years on the job. These individuals have typically been a bench tech for many years. Their experience allows them to take on a leadership role in the department and they are able to answer complex questions or perform some of the routine administrative tasks that are required. Often, in the absence of an educator or clinical coordinator, these individuals are tasked with teaching students.

Supervisor / Manager – those MLS professionals who are at a supervisory or management level may oversee one or more laboratory departments or they might manage an entire laboratory. It would depend on the size of the institution. Often these individuals are MLS who have further education and training, many times with Master's degrees in either business administration or in laboratory management. These individuals may also hold a certification as a specialist in a particular area of the laboratory, and as such, they serve as the expert for a particular department.

Conclusion

The concept of disciplinary literacy examines the ways that members of a particular field read, write, and communicate as part of the typical practices of the profession (Z. H. Fang & Coatoam, 2013; Hynd-Shanahan, 2013). These disciplinary literacy practices are often implicit and are frequently learned indirectly (C. Shanahan & Shanahan, 2014), typically through apprenticeship or observation of the community of practice (Gee, 2015b). Research investigating disciplinary literacy has expanded but is often focused on the four core academic subjects of English, social studies, mathematics, and the natural sciences (Moje, 2007). There has been no research to explore the distinguishing norms of communication that are linked to the disciplinary literacy practices of MLS. The current study will serve to complete the Delphi project that began as part of a pilot study designed to define the disciplinary literacy practices of MLS through a consensus among a panel of MLS experts (Camillo, 2018). This novel method for defining the literacy practices of one discipline provides professionals and educators with explicit details about the tacit practices that are characteristic for the MLS discipline. Incorporating the input of experts in the profession, who are often tasked with apprenticing new professionals, offers authority for the identified practices, which can then be taught explicitly to students. Understanding these practices is also an important part of the Discourse of MLS. Additionally, defining these practices represents a unique approach for reconsidering the professional identity of MLS. Knowing the unique practices associated with the profession provides professionals and educators with a clear understanding of the value of MLS in healthcare. Providing a comprehensive list of practices to important stakeholders, such as administrators, other professionals in

healthcare, and the general public offers a way to enhance the recognition of the profession among these groups, which could support retention in the profession. Plainly stating the distinctive practices of MLS may also help when training or recruiting new professionals, by providing explicit examples of obligations and tasks required of MLS professionals. Trainees are supported as they learn about their new position, enhancing retention, and potential professionals have a clear understanding of what the job entails, which may improve recruitment efforts..

CHAPTER 2

REVIEW OF THE LITERATURE

The highly technical and specialized discipline of MLS represents an area of healthcare that focuses on analysis of patient samples in the laboratory. The profession emphasizes diagnostic testing and establishing proper laboratory analyses using evidence-based methods. This community of practice within healthcare has defined content area knowledge and is very likely to have particular ways of reading, writing, and communicating both within the community itself and with other communities of practice associated with healthcare. However, these disciplinary literacy practices and the overall Discourse of the MLS profession, though often implicitly known by MLS professionals, have not been described in the literature.

There are few research studies that attempt to define a discipline's literacy practices (Brill et al., 2007; Frick, 1990). There are also no studies that examine the connection between disciplinary literacy and professional identity. Discourse and disciplinary literacy both represent important aspects of a profession's identity but historically, the professional identity of MLS has not been well characterized. Because MLS is a highly procedural and scientific field in medicine, research on literacy practices in the profession are uncommon as most research tends to focus on new laboratory methods and instrumentation. Investigation into the specific disciplinary literacy practices and the Discourse of the MLS community of practice could help further define the profession, offering a subjective way to distinguish what MLS professionals do and highlight how important their work really is in order to promote the profession to other members of the healthcare team and the general public. This could contribute to better

retention of current MLS professionals and support recruitment of new students into the profession.

Selection of Articles

Articles for this study were selected using databases available from EBSCO and JSTOR. These databases were examined for research articles that addressed disciplinary literacy, MLS, and professional identity. Books used during previous coursework were evaluated to determine their relevance to the study, and other resources that explored Discourse and communities of practice were also obtained.

As the MLS profession has had several name changes over the years, other terms related to the profession were used in the search, such as Clinical Laboratory Science (CLS) and Medical Technology (MT). There were few articles related to the professional identity of MLS and they were reviewed for relevance. The articles were included if they examined the professional identity of the profession or presented the profession's history, which provided context for the status of the profession's identity. Articles published in professional journals associated with MLS were also considered for inclusion.

When searching the databases, no articles were found when disciplinary literacy and MLS were combined as search terms. As research related to disciplinary literacy is relatively new and often theoretical in nature, articles that were the foundation for this area of research were retrieved to understand the origins of examining disciplinary literacy in education. Research related to disciplinary literacy in other education specialties, particularly in the sciences, and in other areas of healthcare were also explored and included if they offered understanding of what disciplinary literacy might look like in these areas. Articles that related to disciplinary literacy at the college level

were considered for relevance and in all cases, references from selected articles were also evaluated and considered for inclusion. In addition, a search for research defining disciplinary literacy practices revealed two studies that used the Delphi method to define the literacy associated with two different disciplines; visual literacy (Brill et al., 2007) and agricultural literacy (Frick, 1990).

Discourse theory is a related area of research that can be associated with disciplinary literacy, and primary research reports from Gee (2013b, 2014, 2015b) were obtained for reference to understand the foundations of this theory. As each Discourse is associated with a community of practice, resources related to this topic were also identified in order to gain greater understanding of this concept. Professional identity offered more articles, from the nursing profession as well as other, non-healthcare related professions. A number of articles were found that defined both profession and professional identity, examined how professional identity develops in professionals as well as pre-professionals, and its importance to a profession. These resources provided a foundation for understanding professional identity. Research associated with other areas in healthcare, such as nursing, provided insights into how professional identity might affect MLS professionals. References accompanying each article were evaluated to determine if there were other resources that would provide additional knowledge related to the various topics and add insights for the current study.

Organization of the Review

This literature review begins with a discussion of content area literacy as compared to disciplinary literacy, and how each of these types of literacy relates to MLS. There will be a brief discussion of postsecondary education and its relevance when

considering disciplinary literacy. Following that, the research that has defined the literacy practices of certain disciplines will be presented. Discourse theory will also be discussed, to include the importance and definition of text in certain Discourses. In addition, the connection between Discourse and disciplinary literacy will be highlighted to show the significant association between these two concepts. Ultimately, findings will demonstrate that while there are a wide variety of subject areas, disciplines, and professions, the current research in disciplinary literacy is relatively limited in scope. Therefore, more research is needed across many different disciplines to understand the variety of disciplinary literacies. This not only gives a better understanding of each discipline, but also reveals implicit practices in a discipline so that educators can more effectively teach the disciplinary literacy to students.

Professional identity will then be addressed. First, defining what a profession is will be critical so that it is clear what this term encompasses so that it may be compared to the MLS profession. This will be followed by an explanation of how MLS may be defined as a profession, given the findings from this body of research. Next, professional identity will be addressed and will include characterizations of what makes up a professional identity followed by research that addresses the professional identity of MLS. The importance of a profession having a well-defined identity will be explored and current issues in MLS will be considered. Communities of practice are important for professions and for professional identity and this concept will first be defined, and then related to the MLS profession.

Finally, professional identity and disciplinary literacy will be considered together and there will be an evaluation of how they relate to one another. This will be followed

by a discussion about how the literacy practices of MLS could contribute to the profession's identity and could offer new ways of recruiting students and recognition by others in healthcare and the general public.

Content Area Literacy and Disciplinary Literacy

In education research, there is ongoing confusion between disciplinary literacy and content area literacy, and in many cases, educators have a hard time distinguishing the two concepts (Hynd-Shanahan, 2013; C. Shanahan & Shanahan, 2014; Stewart-Dore, 2013). Though these theories are similar, they have some fundamental differences that are important to recognize and identify. The unique attributes of content area literacy and disciplinary literacy provide different ways of thinking about reading and writing in a particular area of education, and differentiating the two helps to better understand the value of disciplinary literacy.

Content Area Literacy

The concept of content area literacy has been around for many years, but picked up momentum in the 1970s when Harold Herber introduced the idea of Content Area Reading, which focused on a set of strategies for processing a variety of texts, without concern for the discipline from which the text came (Z. H. Fang & Coatoam, 2013; T. Shanahan & Shanahan, 2012; Stewart-Dore, 2013). The basic tenet of this concept is that reading and writing require the same set of skills and the content area does not matter (Z. H. Fang & Coatoam, 2013; T. Shanahan & Shanahan, 2012). While each discipline has specific and unique content knowledge, the general literacy skills used to understand and produce content texts can be transferred from one discipline to another (Z. H. Fang & Coatoam, 2013; Hynd-Shanahan, 2013; T. Shanahan & Shanahan, 2012).

With time, these generic strategies evolved and expanded, until the idea that any teacher, no matter the discipline, should be teaching reading skills (Stewart-Dore, 2013). However, Gillis (2014) emphatically argues that “every teacher is *not* a teacher of reading” (p.614, emphasis in the original). She contends that content area teachers are not trained in teaching literacy, but they are knowledgeable in the literacy practices of their discipline (Gillis, 2014). In addition, content area educators consider reading education to be the responsibility of English teachers, particularly at the secondary level, even though reading is generally considered essential for all subject areas (Stewart-Dore, 2013). In fact, there is a large amount of evidence in the research indicating that educators in disciplines outside of English are skeptical of the generic, content area literacy methods and rarely use them in their own practices (Moje, 2008).

MLS Content Knowledge and Content Area Literacy. Once students reach the postsecondary level, content area literacy methods tend to give way to more specific and specialized literacy practices. As medicine and medical knowledge continue to expand and grow (Stead et al., 2011), so does the very specific content knowledge of the MLS profession as it relates to the analytical examination and testing of patient samples. This includes all areas of the laboratory and all phases of testing, from pre-analytical concerns, such as obtaining the right specimen that has been stored and transported appropriately, to analytical evaluation of the samples, to post-analytical consideration for the reliability and accuracy of the results and timely and effective communication of those results. The content knowledge is periodically updated to keep up with the constant changes in medicine (ASCLS, 2015). The content knowledge of MLS represents the foundational information that MLS students must learn in order to be successful members of the

profession. However, generic literacy practices emphasized by content area literacy are not a part of the curriculum for pre-professional MLS students.

In general, MLS professional programs encompass either the last one or two years of a baccalaureate degree, or students may attend a year of training after receiving a baccalaureate degree (NAACLS, 2016a). By the time students reach the MLS professional program at a university or as part of a hospital-based program, they have had many years of education with several opportunities to learn the generic literacy skills that are incorporated into content area literacy. However, content area literacy methods are generally replaced by disciplinary literacy methods by the time students reach college, as unique discipline-specific ways of reading and writing are emphasized in the university curriculum (Cisco, 2016; Holschuh, 2014).

Disciplinary Literacy

In contrast to content area literacy, disciplinary literacy is a relatively new concept in literacy education (Z. H. Fang & Coatoam, 2013; Hynd-Shanahan, 2013). In 2002, the term *disciplinary literacy* was described and founded on the idea that individual disciplines have their own unique forms of literacy and practices that are integral and specific to the discipline (McConachie & Petrosky, 2010; Moje, 2007). However, disciplinary literacy is often mistakenly assumed to be the same as content area literacy (Z. H. Fang & Coatoam, 2013; Hynd-Shanahan, 2013). While content area literacy primarily focuses on a specific set of literacy skills, such as reading and writing, which can be transferred from one discipline to another, disciplinary literacy considers the specific literacy practices that are unique for each discipline (Z. Fang, 2014; Z. H. Fang & Coatoam, 2013; Hynd-Shanahan, 2013; Rainey, Maher, Coupland, Franchi, & Moje,

2018; T. Shanahan & Shanahan, 2012). Disciplinary literacy takes into account not only the content knowledge, but also how members of the discipline communicate, construct knowledge, and manage the language of the discipline, which is recognized as being different from other disciplines (T. Shanahan & Shanahan, 2012).

Several reviews address disciplinary literacy in a variety of ways. In her chapter describing disciplinary literacy and socially just teaching practices, Moje (2007) reviewed a number of research studies that examined the various literacies of different disciplines. Her conclusion was that, while there was diversity in the ways reading and writing are used, and variety in the definitions of literacy for each discipline, all of the disciplines used some form of language, text, or symbolic system to communicate (Moje, 2007). Moje (2007) suggested that students need to have an understanding about how disciplines produce and comprehend the texts associated with a discipline, not just be able to apply reading and writing in a subject area. This knowledge is inclusive, giving students access to the discipline such that they are able to participate in, create, and evaluate the information produced from a discipline, making the students more responsible and thoughtful citizens (Moje, 2007). In her review, Moje (2007) identified a lack of uniformity in the ways each discipline examines literacy and suggested that most of the research is theoretical. She also argued that there have been few studies that have examined applied practices in a classroom and demonstrated learning outcomes (Moje, 2007).

In a follow up commentary, Moje (2008) further defined disciplinary literacy and differentiates it from subject area (i.e. content area) teaching. Moje (2008) argued that a discipline is more than just a category for a list of material or content knowledge.

Instead, Moje (2008) suggested that a discipline involves social interactions between members of the discipline that leads to the creation and communication of knowledge:

Knowledge production in the disciplines operates according to particular norms for everyday practice, conventions for communicating and representing knowledge and ideas, and ways of interacting, defending ideas, and challenging the deeply held ideas of others in the discipline. (p.100)

She furthered her previous argument that, while each discipline is complex and has specific practices and norms, teaching students about how knowledge is created in each discipline gives students tools to be able to evaluate the disciplinary knowledge and critique it, such that they are active and informed citizens (Moje, 2008).

For content area educators, disciplinary literacy instruction may be particularly useful when teaching in specific disciplines. Rainey et al. (2018) suggested that “[d]isciplinary literacy practices are shared language and symbolic tools that members of academic disciplines... used to construct knowledge alongside others” (p.371). Z. Fang (2014) expressed a similar idea by positing that “being literate in a discipline means not only knowledge of disciplinary content but also the ability to read, write, think, and reason with texts in discipline-specific ways” (p.446). This shared language of the discipline becomes important for students to understand so that they are able to engage more completely with the subject area. Starting in middle school, but more commonly at the secondary level and beyond, educators have expertise in a certain discipline and using “*discipline appropriate* literacy practices” (Gillis, 2014, p.621, emphasis in the original) may be most effective for teaching in a particular subject area. A policy research brief issued by the National Council of Teachers of English (2011) stated:

[I]nstruction is most successful when teachers engage their students in thinking, reading, writing, speaking, listening, and interacting in

discipline-specific ways, where literacies and content are not seen as opposites but rather mutually supportive and inextricably linked (p.2)

So while the content area information is important, including the disciplinary literacy aspects improves instruction and encourages students to learn across a variety of disciplines (NCTE, 2011). Understanding how knowledge is constructed within a discipline can provide students with the tools for assessing disciplinary texts and eventually becoming apprenticed into a particular discipline. However, Moje (2008) admitted that there are many challenges in implementing changes to instruction that would reflect disciplinary literacy teaching in the subject areas.

In their article, Goldman and colleagues (2016) described Project READI, which produced a framework for creating learning goals related to reading practices in three specific disciplines: science, history, and literature. Empirical research from each discipline was examined to understand the nuances of disciplinary texts or representations, the discourse within the discipline, and the ways in which experts interact with and read in each discipline (Goldman et al., 2016). The authors acknowledged that each discipline “has negotiated norms and conventions that shape knowledge claims and argumentation within each disciplinary community” (Goldman et al., 2016, p.223). In much the same way as Moje (2008), these authors posit that each of these communities of practice (Wenger, 1998) have different standards and methods for presenting arguments and evidence (Goldman et al., 2016). Goldman and colleagues (2016) presented lists of learning goals specific for each discipline but the authors only focus on reading rather than other areas of disciplinary literacy. This framework, though

grounded in a great deal of literature, is still relatively theoretical and outcomes are unknown.

While much of the research is theoretical, there are some studies that have examined disciplinary literacy in practice. In their influential study examining expert readers, Shanahan, Shanahan and Misischia (2011) found that authorities in a particular discipline read texts from their area of expertise in very specific ways. The methods employed by the experts when reading were different in each of the disciplines that were examined and they found that novices in a particular discipline used different methods for reading as compared to the experts (C. Shanahan et al., 2011; T. Shanahan & Shanahan, 2012). From this research, the authors predicted that teaching more discipline-specific ways of reading and writing could help improve student learning and increase motivation to learn as students are apprenticed into the disciplines (C. Shanahan & Shanahan, 2014; T. Shanahan & Shanahan, 2008).

The study conducted by Shanahan and colleagues (2011) focused specifically on reading practices, though the research was part of a larger, long-term project that aimed to develop and test disciplinary literacy teaching models for secondary education and incorporate them into a pre-service teacher preparation program (C. Shanahan et al., 2011). Because this study only examined reading practices, the other tenets of disciplinary literacy, such as writing and also how the knowledge of the discipline is created, evaluated, and communicated (Z. Fang, 2014; Z. H. Fang & Coatoam, 2013) were not directly addressed.

While reading is often the focus for disciplinary literacy research, Carter (2007) examined writing as an important and specific aspect of each discipline, particularly at

the postsecondary level. Although Carter (2007) recognized that the practice of writing is often viewed as a skill that is achieved outside of the scope of many disciplines, particularly the sciences, he argued for a different perspective, suggesting; "...writing in the disciplines is founded on an integrative relationship between writing and knowing" (p.386). There are discipline-specific ways of writing, such as a laboratory report or business plan, and they are important for students to learn to construct in order to communicate in the discipline (Carter, 2007). However, Carter (2007) pointed out that for many educators and experts in a field, learning to write in the discipline was an implicit process; "...professors typically learn to write in their disciplines not by any direct instruction but by a process of slow acculturation through various apprenticeship discourses" (p.385). Because of the tacit nature of this type of writing experience, experts in a particular discipline do not see the connection between writing and the discipline (Carter, 2007).

Even though much of the literature associated with disciplinary literacy is theoretical, professional associations such as the National Council of Teachers of English (NCTE) support and promote the use of disciplinary literacy teaching methods (NCTE, 2011). While NCTE does acknowledge that disciplines are organized differently in the K-12 setting as compared to that of higher education, they have argued that using disciplinary literacy pedagogy enhances student learning across all subject areas and provides students with critical thinking and reasoning skills (NCTE, 2011).

Postsecondary Disciplinary Education. While much of the research on disciplinary literacy focuses on K-12 students (Z. Fang, 2013; Z. H. Fang & Coatoam, 2013; Moje, 2008; C. Shanahan & Shanahan, 2014; C. Shanahan et al., 2011; T.

Shanahan & Shanahan, 2008), discipline-specific instruction becomes more prominent at the postsecondary level (Holschuh, 2014). It is at this point that students begin to specialize in a particular area of study and they start to identify with their chosen profession (Abrandt Dahlgren, Hult, Dahlgren, af Segerstad, & Johansson, 2006; Barbarà-i-Molinero, Cascón-Pereira, & Hernández-Lara, 2017).

Educators at the postsecondary level generally have Masters or Doctoral-level degrees in their particular areas of specialty, making them experts in their respective fields. In contrast, MLS professionals who work in the hospital and teach pre-professional students typically have Baccalaureate degrees and, less often, a specialty certification. Nevertheless, the MLS professionals in the hospital would also be considered experts as they have day-to-day experience and firsthand knowledge of the typical activities that characterize the profession.

No matter their position, these experts/educators have the opportunity to train students on the discipline's literacy practices, thus providing the students with a better understanding about the specific ways the discipline communicates and shares knowledge, giving students the tools needed to become successful in the field (T. Shanahan & Shanahan, 2012). However, much of this disciplinary knowledge is implicit within a field of study and in order to teach students effectively, these practices must become explicit (Hynd-Shanahan, 2013; Moje, 2007; C. Shanahan & Shanahan, 2014). By defining the disciplinary literacy practices of a profession, these implicit practices can be made obvious for both educators and students, and may be key to successfully apprenticing students into a discipline.

Disciplinary Literacy of MLS. As with most professions, it is very likely that there are unique disciplinary literacy practices related to the MLS profession. However these practices have neither been explored nor defined in the literature. In fact, like many professions, the discipline specific practices of MLS are often learned through experience instead of being taught directly (Hynd-Shanahan, 2013; Moje, 2007; C. Shanahan & Shanahan, 2014). Understanding the disciplinary literacy practices of the MLS profession would give educators clear ideas about the social norms and communication methods that are characteristic for the discipline, which they would then be able to convey to the students.

Defining a Discipline's Literacy Practices

Although some general reading practices have been cited for particular disciplines, such as chemistry, science, math, literature, and history (Goldman et al., 2016; C. Shanahan et al., 2011), the literature defining other literacy practices for a wide range of disciplines is sparse.

One study that did attempt to define a particular type of literacy was conducted by Brill et al. (2007); this study sought to better understand the term visual literacy and determine a definition that could be used by researchers in the field of visual literacy. Brill et al. (2007) contended that there was not an agreed-upon definition for visual literacy and that having this definition would advance research in the field. Using the consensus-building research method known as the Delphi method, established researchers with peer reviewed publications and presentations in visual literacy were recruited as experts. These experts were asked to define visual literacy as part of their own research

and practice. The results of the study provided a tentative definition for the field, but also raised questions about the cohesiveness of the scholars examining visual literacy.

In an effort to define another type of literacy, Frick (1990) examined agricultural literacy and attempted to describe and conceptualize that term in order to provide educators with information to help in teaching this concept. This is another instance where the Delphi method was used and experts were recruited to formulate a definition for agricultural literacy. Findings from this study demonstrated a broad range of subject areas associated with agricultural literacy. Based on these findings, Frick (1990) formulated a recommendation for enhancing and adding to the subject areas associated with agricultural education and literacy so they could be used in the classroom to improve instruction related to agriculture.

In another study, Pytash (2012) conducted a semester-long qualitative study of pre-service teachers in which she incorporated disciplinary literacy assignments into the coursework to see how the pre-service teachers' teaching methods for writing in their discipline changed over the course of the semester. She found that perceptions for teaching disciplinary writing changed such that the pre-service teachers felt disciplinary literacy pedagogy would be more valuable for their students (Pytash, 2012). The pre-service teachers not only read articles as a means to discern the types of writing that are part of their discipline, but they also contacted professionals to understand why and how they write in their profession (Pytash, 2012). The input from experts helped the pre-service teachers see the type of language used as well as the discourse for the discipline, in addition to the types of writing that are prominent in the field (Pytash, 2012). Furthermore, Pytash (2012) used her own area of expertise to model discipline-specific

methods for reading and writing commentaries in politics, serving as an example to the students so they could understand how to teach using disciplinary literacy pedagogy.

These articles represent the limited number of research studies that have attempted to define or understand a discipline's literacy. Two of the studies used the consensus-building Delphi method. This method offered the researchers a way to gather ideas and opinions from experts in a field without having personal interactions (Brill et al., 2007; Frick, 1990). The concern was that stronger personalities could override other ideas in face-to-face venues, thus limiting the outcome of the consensus (Frick, 1990). By using questionnaires, all voices and opinions could be taken into account and evaluated (Brill et al., 2007; Frick, 1990). These articles also demonstrate that by gathering data from experts in a particular discipline, the findings are more likely to reflect the true literacy practices used by members of the discipline.

Discourse Theory

The evolution of sociocultural learning theories, coupled with concepts of language in use, brought about Gee's (2015b) idea of a Discourse. While actual language in use is what Gee (2014) terms small 'd' discourse, the big 'D' discourse embodies not only contextualized language, but also how individuals act, feel, think, interact with others, and even includes their clothing choices (Gee, 2013a, 2014, 2015b). The social construction of Discourses allows individuals to be identified as being a member of a particular Discourse. The language that is used, the expressions that are made, and the mannerisms of the individual signal to others that they are part of that Discourse, and others are able to recognize their membership in the Discourse (Gee, 2015b; Unrau & Alvermann, 2013). As Gee states; "D/discourse theory is about seeing interactive

communication through the lens of socially meaningful identities” (Gee, 2014, p.25).

Essentially, a Discourse conveys an identity that can be socially recognized (Gee, 2014, 2015a, 2015b).

Another principle that Gee (2015b) puts forth is the idea that individuals can be part of a variety of Discourses, and that the Discourses individuals associate with can change over time. However, Gee (2015b) posits that all individuals are introduced to a Discourse early in their lives that serves as an original, or “primary Discourse” (p.173). This primary Discourse is the basis for an individual’s personality and sense of who they are; it is influenced by family, culture, and socialization and can be associated with a certain language as well as impact behavior (Gee, 2015b). An individual’s primary Discourse is not static, however, and it can change with time and experience, even to the point where it disappears altogether (Gee, 2015b). No matter the form it takes, primary Discourse serves as a foundation that influences all of the individual’s other Discourses (Gee, 2015b).

Once an individual begins socializing with others outside of their immediate family, they begin to develop what Gee (2015b) terms “secondary Discourses” (p.174). These Discourses are described as “those to which people are apprenticed as part of their socialisations [*sic*] within various local, state and national groups and institutions outside early home and peer-group socialisation [*sic*]” (p.188). An individual’s secondary Discourses can be numerous, depending on their various relationships, pursuits, and beliefs; they can affect and influence other Discourses; and they can also change over time (Gee, 2015b). Secondary Discourses can be connected to educational institutions, professions, hobbies, interests, political associations, and many other social groups (Gee,

2015a, 2015b). In some cases, primary Discourses can be strongly influenced by secondary Discourses if they are valued by a particular group (Gee, 2015b). For instance, parents who communicate with their children early on using certain language and particular practices that are more closely associated with school languages and customs are giving their children an early advantage in understanding the Discourse of formal schooling (Gee, 2015b).

Individuals become socialized into Discourses through what Gee (2015b) characterizes as a continuum between acquisition and learning. Acquisition happens when individuals are exposed to a social group and observe the traditions, values, language, and practices of the group. This generally happens without any official teaching; the individual is enculturated into the various social practices of the Discourse through interactions with other, more experienced members of the Discourse (Gee, 2015b). Learning, on the other hand, involves some form of teaching which requires explicit instruction and formal explanation along with more detailed analysis and reflection (Gee, 2015b). Given these descriptions, Gee (2015b) argues that “Discourses are mastered through acquisition, not learning” (p.190). So while the content knowledge that is characteristic of a particular Discourse is important for members of the Discourse to know, the implicit values, social standards, and associations that are also part of the Discourse are often not explicitly taught and are learned through experience (Gee, 2015b).

Text and Discourse

Members of any secondary Discourse must be able to communicate with one another, which “involves[s] uses of language, either written or oral, or both, as well as

ways of thinking, valuing and behaving” (Gee, 2015b, p.194). In fact, Gee defines literacy as a “Mastery of a secondary Discourse” (Gee, 2015b, p.196). Therefore, mastering a Discourse requires having a full understanding not only of the social aspects, but also the texts associated with the Discourse (Gee, 2015b).

The texts that relate to a Discourse are not limited to materials with written language on them. Gee (2015b) refers to a text as a “prop” (p.196) associated with a Discourse. This is a similar concept to one presented by Draper and colleagues (2010), where different disciplines have a variety of “text-like objects” (p.28) that students must be able to interpret or produce such that they make sense to others in the discipline. A text could be anything that can have meaning and purpose within a certain context (Draper, Broomhead, Jensen, Nokes, & Siebert, 2010). For instance, a thermometer is ‘read’ by a student to tell her what temperature a water bath is and whether she can use it for an experiment. An image of an animal is ‘read’ by another student, who identifies the animal as a giraffe. Or a mathematics equation is ‘read’ by a student, who must then provide a solution to the problem. The text in each of these cases is quite different, but particular for each discipline.

The Relationship between Discourse and Disciplinary Literacy

There are many similarities and connections between disciplinary literacy and Gee’s Discourse theory, though often they are not explicitly stated in the literature. In her review of disciplinary literacy research and how it relates to mathematics education, Hillman (2014) makes a direct connection between disciplinary literacy and Discourse theory:

Disciplinary literacy as communication among experts is grounded in discourse theory... Social linguist James Gee... proposed his own theory,

describing his term *Discourse* as drawing from a dozen theorists, including Foucault's discourses, Lave and Wenger's communities of practice, and Wittgenstein's forms of life. Gee's theory represents his 20-year evolution from focusing on isolated language to studying language in use shaped by the values of society and cultural context, including occupations. (p.398, italics in the original)

Fang and Coatoam (2013) suggest that "being literate in a discipline means understanding of both disciplinary content and disciplinary habits of mind (i.e., ways of reading, writing, viewing, speaking, thinking, reasoning, and critiquing)" (p.628). This description shares similarities with Gee's concept of Discourse, which he describes as:

[A] socially accepted association among ways of using language and other symbolic expressions, of thinking, feeling, believing, valuing and acting, as well as using various tools, technologies, or props that can be used to identify oneself as a member of a socially meaningful group or 'social network', to signal (that one is playing) a socially meaningful 'role', or to signal that one is filling a social niche in a distinctively recognisable [*sic*] fashion (Gee, 2015b, p.178-179)

The habits of mind that Fang and Coatoam (2013) identify include reading and writing practices (i.e. language) along with thinking and reasoning (i.e. thinking, feeling, believing, and valuing). The production of knowledge in a discipline "operates according to particular norms for everyday practice, conventions for communicating and representing knowledge and ideas, and ways of interacting, defending ideas, and challenging the deeply held ideas of others in the discipline" (Moje, 2008, p.100). The knowledge and customs of each discipline are socially constructed with other members of the Discourse and can be recognized by those outside of the Discourse.

Gee (2015b) also focuses on identity, which is "shaped by communities whose languages we share" (Hillman, 2014, p.398). Full members in a Discourse are in a position to apprentice new members, so they learn not only the knowledge but also the social characteristics of the Discourse (Gee, 2015b; Wenger, 1998). Educators that

identify as a member of a discipline (i.e. Discourse) will be more effective at providing opportunities for students to acquire their new Discourse. If disciplinary literacy asks students to think, read, write, and communicate in the ways that an expert would, they are being apprenticed into that Discourse (Z. H. Fang & Coatoam, 2013; Gee, 2015b; Hillman, 2014).

Implications for Research on Disciplinary Literacy

The primary implication that becomes evident from examining the research in disciplinary literacy is that more research is needed across many disciplines. There is a lack of information on what the disciplinary literacy practices look like for a multitude of disciplines and this presents a problem to educators who are trying to apprentice students into a particular discipline or profession. The expert reader study examined reading in history, chemistry, and mathematics (C. Shanahan et al., 2011), but this type of study has not been conducted in other disciplines and only focused on reading, which is just one attribute of disciplinary literacy. Project READI developed learning goals for reading in science, history, and literature by assessing the research related to characteristic literacy practices for each discipline (Goldman et al., 2016). However, findings from the study were limited to just reading practices in each area of specialty (Goldman et al., 2016). More research is needed in each of the areas that contribute to the literacy of a discipline.

Oftentimes, the disciplinary literacy is implicit (C. Shanahan & Shanahan, 2014) and educators are tasked with identifying the practices they should be teaching on their own. For pre-service educators, modeling and input from experts could be one way to reveal disciplinary practices (Pytash, 2012). The same may be true of other educators in a variety of disciplines, including MLS, and making disciplinary literacy practices

explicit will benefit both educators and professionals such that they will have a better understanding about their discipline.

Professional Identity

Professional identity begins to take shape as students become educated and move toward membership in their chosen profession (Reid, Dahlgren, Petocz, & Abrandt Dahlgren, 2008). The absence of a consistent MLS professional identity could contribute to some of the retention concerns for the profession. In particular, a refined professional identity would provide others in the healthcare setting, as well as the general public, with a solid concept of the type of work that MLS professionals do and its importance as part of patient care. The laboratory employs experts in laboratory testing methods and analysis. These professionals could work with others in healthcare and offer unique insights in finding new ways to provide quality patient care. A more consistent MLS professional identity might help to address recognition of the profession and support motivation of new professionals.

Defining Profession

In a decision by the National Labor Relations Board, medical technologists (now MLS) were determined to be professional employees (*Case 33-RC-2460*, 1982). In the decision, a professional was defined in Section 2(12) of the National Labor Relations Act (*Case 33-RC-2460*, 1982) as:

(a) any employee engaged in work (i) predominantly intellectual and varied in character as opposed to routine mental, manual, mechanical, or physical work; (ii) involving the consistent exercise of discretion and judgement in its performance; (iii) of such character that the output produced or the result accomplished cannot be standardized in relation to a given period of time; (iv) requiring knowledge of an advanced type in a field of science or learning customarily acquired by a prolonged course of specialized

intellectual instruction and study in an institution of higher learning or a hospital, as distinguished from a general academic education or from an apprenticeship or from training in the performance of routine mental, manual, or physical processes... (NLRB, 1982, p.1048)

Given this definition, professionals participate in work that requires specialized knowledge and an academic background to achieve. The activities are not always consistent and sometimes require a critical analysis of the method or outcome of the action. Similar to this concept of a professional, Bragg (1976) explained that an occupation may be defined as a profession when it has the following features:

(1) it has a distinct body of esoteric knowledge derived from empirical research, scholarly activity, and/or logical analysis; (2) it possesses a special craftsmanship or technique through which this knowledge is applied to the human social condition; and (3) it tends to hold a monopoly on the social application of this knowledge and technique--a monopoly granted by a society in need of the professional's knowledge and skills with the condition that the professionals in concert set standards for entry and continuance in professional practice (p.12)

As such, professions have a specific body of knowledge and offer a service to the general population that addresses a particular problem, which makes their service economically valued (Barbarà-i-Molinero et al., 2017; Pratt, Rockmann, & Kaufmann, 2006). In addition, a profession should monitor its own members and set the standards for entry into and continued participation with the profession (Bragg, 1976).

MLS as a Profession. When considering these two definitions of a professional and a profession, the activities and requirements of an MLS certainly meet the conditions of a profession with professional members. MLS professionals are required to complete education and training beyond the secondary level in specific areas of science, meeting the outlined obligations for Section 2(12)(a)(iv) of the National Labor Relations Act (*Case 33-RC-2460*, 1982). In addition, daily activities of MLS professionals are varied,

many cannot be automated, and often results require critical evaluation and judgement. Each of these fulfills Section 2(12)(a)(i, ii, and iii) of the National Labor Relations Act (*Case 33-RC-2460*, 1982).

When considering the requirements of a profession as outlined by Bragg (1976), the MLS profession has a known and evolving body of knowledge that is shared among practitioners and with students (ASCLS, 2015), demonstrating the first feature of Bragg's definition. MLS professionals use a variety of specific and specialized techniques for testing patient samples, the results of which are used by physicians, physician assistants, and nurses. These tests are specialized to the profession and applied to patients on a daily basis, meeting the second feature of Bragg's (1976) characterization of a profession. As these test results provide important information for accurate and timely treatment of patients, they are valued, which demonstrates the third feature of a profession as defined by Bragg (1976).

Obtaining certification and entry into the MLS profession can be achieved through a few different pathways (ASCP_BOC, 2018b). However, the MLS profession corresponds with Bragg's (1976) concept because there are set guidelines in order to meet the necessary requirements to sit for the certification examination and to maintain this certification over time. One of the first steps that a student might take is choosing a National Accrediting Agency for Clinical Laboratory Science (NAACLS) accredited program. NAACLS is an independent organization with both MLS and pathologist representatives (NAACLS, 2016b).

Consistent with Bragg's (1976) definition, professionals set the requirements for entry into the profession with the certification examination. Though the certification

examination is managed by the Board of Certification (BOC, formerly the BOR) under the ASCP, there is now significant representation on the Board from MLS professionals (ASCP_BOC, 2017b). The questions for this examination are maintained by working groups for each particular content area and are made up of MLS professionals and pathologists with expertise in each section of the laboratory (ASCP_BOC, 2017a). Once certified, each MLS professional must participate in a certain number of continuing education credits each year in order to maintain their certification. In this way, members of the profession monitor other members and set the standards for entry and continued participation over time (Bragg, 1976).

Defining Professional Identity

One way of thinking about professional identity comes from Pratt et al. (2006) in which the authors state that "[p]rofessionals... are often defined by *what they do*" (p.236, emphasis in the original) rather than where they work. Although several authors have indicated that there is not a unified definition of professional identity (Nadelson et al., 2017; Trede, Macklin, & Bridges, 2012), in one instance professional identity has been defined as "the relatively stable and enduring constellation of attributes, beliefs, values, motives, and experiences in terms of which people define themselves in a professional role" (Ibarra, 1999, p.764-765). Put another way, professional identity could be defined by three characteristics: Having knowledge, skills, and values that are shared by those in the profession; differentiation from other professions; and having a strong association with the profession (Jackson, 2016; Trede et al., 2012). Essentially, these concepts go beyond just the content knowledge and daily activities of the profession and instead

incorporate the unique sociocultural aspects that are associated with those who practice in the profession.

The Professional Identity of MLS. There are few research articles that discuss the professional identity of MLS practitioners, but overall the literature suggests that the professional identity of MLS is not well defined (Evans, 1968; Grant, 2007). Both Evans (1968) and Grant (2007) suggest that the professional identity of MLS professionals has been affected by the pathologists and physicians who have sought to maintain control over the laboratory for many years, preventing the MLS professionals from taking a more prominent role in the healthcare setting. It is this, both Evans and Grant argue, what has hindered the establishment and growth of the MLS professional identity. This is an ongoing issue, particularly when MLS professionals are content to defer to the physician's orders, even when these professionals know of a better test that will provide more useful information or when they know that a test request is wrong given the clinical picture of the patient (Ferraro et al., 2016). Some research has argued that the professional identity of MLS has been stalled because laboratory workers have been discouraged from trying to become a distinct and separate profession from pathologists (Kotlarz, 1998a, 1999b).

Other research examining the professional identity of MLS professionals showed laboratory workers feel that their profession is very important and that what they do makes a difference for patients, but they think others in healthcare do not understand the value of the work from laboratory professionals (Butina & Schell, 2011; Ferraro et al., 2016). This can affect morale and retention. In addition, the general public is largely

unaware of the MLS profession, which not only affects recruitment, but also contributes to the lack of a professional identity for MLS (Evans, 1968).

A study conducted by Miller (2014) examined the identity of clinical instructors who provide educational experiences for students during their clinical internships. The subjects of Miller's study were MLS professionals who were teaching in addition to performing their clinical duties. Miller found that teaching was one component of the professional identity of these participants, though these instructors fell along a continuum, where some greatly valued their position as an educator in the clinical setting while others felt it was one more thing to do in addition to their normally assigned duties. Miller's conclusion was that instructor identity was one aspect of the professional identity of MLS, but did not directly address any other characteristics of the profession's identity (Miller, 2014).

Ibarra (1999), Jackson (2016), and Trede et al. (2012) all suggest a social aspect of professional identity, therefore an understanding of the communities of practice associated with MLS is an important area to explore. These communities of practice, which can be made up of a professional's particular department within a hospital, the professionals in the larger laboratory setting within a hospital, and the larger MLS community, can have an effect on professional identity.

The Importance of Professional Identity

In their commentary discussing the development of a professional identity for the Information Systems research community, Benbasat and Zmud (2003) outline important reasons why organizational, or professional, identity is important. The first relates to a set of standards that are accepted by the population within the profession, and that are

being explored in scholarly works by members of the profession. These provide a solid foundation and offer boundaries and knowledge that is specific for that group. Given the constant changes in medicine, the periodic updates in the MLS body of knowledge that reflect medical advancements, and the accepted qualifications required to be certified as an MLS, this is an area where the MLS professional identity is more established.

The second reason professional identity is important relates to legitimacy. Benbasat and Zmud (2003) summarize two types of legitimacy; cognitive and sociopolitical. Cognitive legitimacy involves researchers within the profession exploring the nature of the discipline in a way that keeps the core knowledge of the profession intact. Otherwise the scholarly endeavors of the profession are ambiguous and vague. While not all practicing MLS professionals conduct research, there are some members of the profession who do participate in research and pursue publication in *Clinical Laboratory Science*, the journal of the ASCLS. Topics covered in the journal include education, research, and government policy affecting laboratory workers (ASCLS, 2017). Each of these areas has a significant impact on the profession, so the cognitive legitimacy associated with the MLS profession has been established. However, there are many professionals who are not part of the ASCLS membership and who do not participate in research. Many times increased workload and inadequate staffing contribute to dissatisfaction with the profession (Doig & Beck, 2005). These would also contribute to an inability to conduct research. Moreover, participation in professional endeavors such as research are often not supported by hospital administration because the activities would take away from patient care and would not be reimbursed to the hospital. This lack of support for research limits growth opportunities and recognition of the

professionals, further contributing to retention concerns (Doig & Beck, 2005) and impairing the sociopolitical legitimacy (Benbasat & Zmud, 2003) of MLS.

The sociopolitical legitimacy of MLS is an area of professional identity that has the potential for the most improvement. This concept relates to acceptance of the profession by important stakeholders including the general public, government, and other leaders (Benbasat & Zmud, 2003). As Benbasat & Zmud (2003) point out; “if influential stakeholders are unable to comprehend the nature, importance, and distinctiveness of the role being served by the... discipline, these stakeholders are unlikely to acknowledge its legitimacy” (p.185). Throughout its history, the MLS profession has struggled for recognition by both the general public and others in healthcare (Kotlarz, 1998a, 1998b, 1998c). This deficiency in sociopolitical legitimacy continues to be a problem for the profession, particularly as it relates to retention of employees and attrition (Beck & Doig, 2005; Doig & Beck, 2005). In addition, recognition by the general public could help with understanding the value of laboratory work and enhance recruitment to bring new students into the profession. Addressing this area of professional identity is important for improving the outlook of the profession as staffing shortages are likely to continue (Beck & Doig, 2005).

A profession can be defined as an occupation that is a valued service to society, has a distinct body of knowledge, and that monitors and maintains its membership (Barbarà-i-Molinero et al., 2017; Bragg, 1976; Pratt et al., 2006). MLS can be considered a profession by these standards. MLS practitioners can be considered professionals as outlined by the National Labor Relations Act, since professionals must get a degree in higher education with a focus in science and the work that is performed on a daily basis

often cannot be automated, varies from day to day, and requires critical thinking and evaluation skills (*Case 33-RC-2460*, 1982). One way to define professional identity is that members have a strong association with their profession, they share knowledge and ideals with others in the profession, and they are able to distinguish themselves from other professions (Jackson, 2016; Trede et al., 2012). However, research examining the professional identity of MLS has demonstrated it is not well defined and may have an effect on recruitment of students and retention of current professionals in the field (ASCLS, 2018a; Beck & Doig, 2005; Butina & Schell, 2011; Doig & Beck, 2005; Evans, 1968; Funnye-Doby, 2016; Grant, 2007; Rothenberg, 2017). Professional identity is important, however, as it helps define the profession through a set of acknowledged standards and legitimizes the profession to those who are part of the community through research (Benbasat & Zmud, 2003). In addition, sociopolitical legitimacy means important stakeholders outside of the profession recognize the value of the profession, which enhances professional identity (Benbasat & Zmud, 2003). In the case of MLS, the value of having a refined professional identity could mean better recognition by the general public, greater recruitment opportunities for new professionals, and recognition by others in healthcare that could help with retention and motivation concerns.

Communities of Practice

While there are many communities of practice that an individual might interact with, workplace communities of practice are most important in influencing professional identity. In the workplace, there are both formal and informal communities of practice. Hara and Schwen (2006) have defined a community of practice to be a group of people who share meaning and knowledge building among a group of professionals, and

includes informal social networks that provide a supportive culture. These communities of practice enhance the learning opportunities for all professionals and support professional pride and identity.

The framework of a Discourse as outlined by Gee is somewhat similar to Wenger's (1998) idea of communities of practice (Goldman et al., 2016; Hillman, 2014). Wenger's communities of practice are built on mutual engagement (e.g. social practices), where the participants share and negotiate a history, resources, and learning (e.g. traditions, norms, values, language) (Wenger, 1998). New members to a community of practice must be apprenticed (e.g. acquisition) by more experienced members such that they are engaged, gain legitimacy, and learn the actual practice of the community (Wenger, 1998). For both Discourses and communities of practice, mastery involves apprenticeship into the knowledge and social ways of being specific for a particular group.

In the study conducted by Hart and Bennett (2013), the authors indicate "content area disciplines represent separate communities of practice, with unique discourses—shared repertoires of language, tools, routines, gesture, symbols, actions, and ways of being" (p.225). These authors effectively combine the concepts of disciplinary literacy, Discourse theory, and communities of practice. They feel that teachers should be teaching more than just content knowledge, and include the social practices of a discipline (Hart & Bennett, 2013). However, their study reveals that this is no easy task and suggest educators must collaborate in order to create effective disciplinary literacy courses (Hart & Bennett, 2013).

The MLS Community of Practice

Given the definition above, it would be expected that each hospital laboratory across the country has an MLS community of practice associated with the laboratory workers. In addition, there is a larger community of MLS professionals connected with professional organizations and educators in academic settings. These are the communities into which students are apprenticed as part of their training, helping them move from pre-professional to novice professional (Abrandt Dahlgren et al., 2006; Hara & Schwen, 2006). In general, the students who are learning about and being trained in a particular profession must also become familiar with the community of practice (Nyström, 2009).

Professional Identity and Disciplinary Literacy

Disciplinary literacy practices represent one part of a profession's overall identity, which includes the knowledge, values, and purpose of the profession (Ibarra, 1999; Jackson, 2016). Many professions have established professional identities, but MLS has a long history of a poorly defined professional identity. In addition, the disciplinary literacy practices of the profession have not been explored in the literature. The unique characteristics of MLS, including educational requirements and the specific practices that a professional is able to perform (Kotlarz, 2000), includes the disciplinary literacy practices. In addition, Kotlarz (2000) highlights what she calls the "professional ethos: characteristics, attitudes, and habits displayed by those in professional practice" (p.169) as part of the professional identity of MLS. Included in this professional philosophy are the "habits of mind" (Fang & Coatoam, 2013, p.628) of the discipline. How professionals read, write, and communicate represents an important aspect of a

profession's identity. A professional identity develops when one participates and is recognized as a contributing member of the discipline (Luehmann & Tinelli, 2008), which would include the various forms of communication specific to a profession.

As disciplinary literacy is part of a profession's identity, understanding the disciplinary literacy practices of MLS will help with characterizing the professional identity of MLS. Interpreting the explicit disciplinary literacy practices could also help educators to teach these practices to students, improving their comprehension of the content and establishing a strong pre-professional identity prior to entry into the workforce. This could help increase morale and retention and decrease attrition in the profession (ASCLS, 2018a; Beck & Doig, 2005; Doig & Beck, 2005; Funnye-Doby, 2016; Rothenberg, 2017).

The development of professional identity begins when students are learning about their chosen profession (Barbarà-i-Molinero et al., 2017; Jackson, 2016; Nyström, 2009). This is the time when pre-professionals are apprenticed into the field and includes learning disciplinary literacy practices related to the profession. To better prepare MLS students, instruction of the disciplinary literacy practices associated with MLS could be an important aspect of their education and contribute to their pre-professional identities. Since there is currently no explicit understanding of the specific MLS disciplinary literacy practices, there is an opportunity to learn more.

Conclusion

Defining the literacy of an entire discipline is a large task (Brill et al., 2007). There is a unique body of knowledge, social norms, Discourses, and communication practices that are important to consider for any discipline (Bragg, 1976; Z. H. Fang &

Coatoam, 2013; Gee, 2015b; Ibarra, 1999). However, there are important benefits to understanding the literacy practices of a discipline in that they can contribute to understanding the profession and enhance the professional identity of individuals that are part of the discipline or Discourse. While much of the research in disciplinary literacy is theoretical (Goldman et al., 2016; Moje, 2007; C. Shanahan et al., 2011), there are a few studies that outline how to define a discipline's literacy practices (Brill et al., 2007; Frick, 1990). However, each of these studies makes clear that conferring with experts in the profession is vital to understanding all aspects of the discipline's literacy. By bringing experts together to come to a consensus about what practices are included in the disciplinary literacy of MLS, professionals and educators can have a clear understanding of the importance of the profession and the specific practices that make MLS unique in healthcare. From this, a refined professional identity can develop which will allow cognitive legitimacy among members of the profession and sociopolitical legitimacy among individuals who are outside of the profession (Benbasat & Zmud, 2003). A better understanding of the professional identity of MLS could help with recognition by members of the general public and recruitment of new students, and could help others in healthcare acknowledge the laboratory and enhance motivation and retention of current employees.

CHAPTER 3

METHODOLOGY

The purpose of this study was to continue pilot project research examining and defining the disciplinary literacy practices of MLS using the consensus-building research method known as the classic Delphi method. A previously defined panel of experts in the MLS profession was surveyed to complete the third, and final round of data collection for the Delphi project that began during the pilot project. Using data collected throughout the Delphi project, another instrument was developed to survey a larger and more diverse group of MLS professionals. This additional survey was incorporated into the study in order to examine the findings from the Delphi project and determine if there was agreement between the expert panel and the MLS practitioners on the identified disciplinary literacy practices of MLS. A brief description of the Delphi method is presented below to provide context.

Description of the Delphi Method

For a general, classic Delphi study, a panel of experts in a particular field is assembled in order to answer a particular problem or discover a solution to a particular technical concern. The participants answer a series of questionnaires that are sent out at different times. Each questionnaire is called a round and the number of rounds can vary depending on the study, but 3-5 rounds is typical (Hasson et al., 2000; Maxey & Kezar, 2016). Using an iterative process examining the responses from the expert panel, a consensus may be reached related to the particular problem or technical issue of concern (Hasson et al., 2000; Linstone & Turoff, 2002; Maxey & Kezar, 2016). Each round of a general, classic Delphi project is described briefly:

Round One

Questions for this round are open-ended to allow the respondents freedom in expressing the whole of their thoughts and opinions related to the problem (Hasson et al., 2000). This qualitative round is generally broad and responses determine the focus for the questions used in subsequent rounds (Maxey & Kezar, 2016).

Round Two

Questions for the second round survey are created by evaluating the responses from the Round One data. Concepts related to the research question or identified problem that is being addressed are combined and consolidated from the Round One responses. This information is compiled into a survey with closed-answer questions, using Likert-like or ordinal scales, or an agree-disagree continuum (Hasson et al., 2000) to present the ideas back to the expert panel for evaluation. Including a comment option as part of the quantitative survey can gather additional information that might be missed when using closed-answer questions (Brill et al., 2007).

Round Three

Questions for the third round survey are created using data gathered from both Rounds One and Two in a similar manner as described above. Ideas related to the problem or question are consolidated further, bringing all ideas together to find a solution to the problem. The next set of questions is presented to the experts in order to move toward consensus and find a solution for the problem or an answer to the question that is being examined. This survey has closed-answer questions similar to what was described for Round Two.

Research Question

Using ideas from Fang and Coatoam (2013) that consider reading, writing, and communication to be important components of disciplinary literacy, broad ideas were initially gathered from experts in the field during the pilot project, and were further refined until a consensus was reached among the panel. In order to further confirm the findings from the MLS experts, an additional survey, which was beyond the scope of the Delphi project, was developed and sent to a larger group of MLS practitioners. This additional step allowed professionals in a variety of institutional settings and with a range of years of experience and qualifications to evaluate the disciplinary literacy practices of MLS that were identified by the expert panel such that they could either agree with the practices, or not. Agreement with the practices among the MLS practitioners would suggest corroboration with the findings from the Delphi project. In addition, questions related to professional identity were included in the MLS practitioner survey to gain an understanding about current perspectives of the MLS professional identity. The primary research questions and three sub-questions were:

1. What are the disciplinary literacy practices of MLS as defined by the expert panel?
 - a. What reading/interpreting practices are typical in the profession? What types of materials are typically read/interpreted and for what purpose? This may include documents that use written words or other sign systems (numeric values, visual representations, or involve equipment used in the field).

- b. What writing/production practices are typical in the profession? What is typically written/produced and what is the purpose of writing/producing those materials? This may include documents that use written words or other sign systems (numeric values, visual representations, equipment preparation or use) that communicate information in the discipline.
 - c. What forms of oral communication are typically used by MLS professionals? This includes communication between others in the profession, with others in healthcare, and with people outside of the healthcare setting.
 2. Do other members of the MLS profession agree with the consensus reached by the expert panel defining disciplinary literacy practices of MLS?
 3. What are the perceptions of MLS Practitioners and their professional identity? Do disciplinary literacy practices influence the professional identity of MLS professionals and their role as part of the healthcare team?

This study represents a continuation of a previous pilot project (Camillo, 2018), which was encompassed the first round survey and data analysis for the Delphi method and included the development of the survey used for round two. Deployment of the Round Two survey occurred after the pilot project and before the beginning of this study in order to maintain participation and interest among the expert panel. The current study completes the Delphi project by first analyzing the data from the Round Two survey, developing the Round Three survey, and completing the analysis of data from all three rounds. Following the third round of data collection for the Delphi project, an additional instrument was designed to determine the level of support for the Delphi findings by

surveying other MLS professionals to ascertain their level of agreement with the disciplinary literacy practices that reached consensus from the MLS expert panel. This step was used to determine whether other MLS professionals agreed with the findings from the Delphi project. If the MLS professionals agreed with the expert panel, the trustworthiness of the results from the Delphi project would be supported.

Researcher Positionality

I am a certified MLS and have used my skills in both veterinary and human healthcare settings. I am now an educator and, broadly speaking, my goal is to instruct and apprentice students into their new profession. Through my varied experiences, I believe that there are very specific disciplinary literacy practices in MLS that have not been defined or explored in the literature. This may be due to the fact that MLS is a highly technical and scientific area of specialization in healthcare. Most researchers in the field focus on the latest developments in testing methods, disease detection, biomarkers, instrumentation, regulation, and other medical advances. For MLS educators, topics of interest include student engagement and retention, technology, and pedagogy. Literacy and disciplinary literacy practices have not been a part of the collective discussion, but researching the implicit practices to make them explicit could offer new information for educators to enhance their curriculum and provide current MLS professionals with a new framework for understanding their discipline. In turn, understanding the disciplinary literacy practices of MLS could lead to novice professionals who are more prepared to enter the workforce, and provide clear evidence related to the value of MLS in healthcare which could be used to advance recognition of

the profession among important stakeholders and enhance motivation and retention of current professionals in the field.

I believe that the habits of mind (Z. H. Fang & Coatoam, 2013) of disciplinary literacy, along with a more detailed understanding of the Discourse (Gee, 2015b) of the profession, can be a way to inform and describe the MLS professional identity. Kotlarz (2000) points out:

The professional identity of [clinical laboratory science] CLS encompasses those attributes that make the field unique, not only in terms of scope of practice, educational preparation, and credentialing, but also with respect to the development of a professional ethos: characteristics, attitudes, and habits displayed by those in professional practice. (p.169)

The history of the MLS profession shows that our professional identity has always been ill-defined and there have been several obstacles that have prevented a cohesive professional identity. Both professional identity and disciplinary literacy are, I believe, interrelated; both are dependent upon the other and insight and investigation of each area is necessary for a more complete comprehension of this unique area of healthcare.

Brief Description of the Pilot Project

The pilot project determined the members of the expert panel, developed and deployed the Round One survey, which was followed by an analysis of the Round One data. In addition, the Round Two survey was developed (Camillo, 2018). As the pilot project was bound by a semester timeline, the Round Two survey was deployed after the conclusion of the semester, over a summer break, in order to maintain participation and keep the timeline consistent.

Nomination of Experts

Experts were nominated by their peers or through self-nomination. MLS experts were defined as practicing or recently retired professionals and/or educators with a minimum of 10 years of experience in the profession. Retired MLS professionals should have been active in the profession within the last 5 years. Contact information for nominees was collected through a survey (Camillo, 2018). These experts were recruited from across the country using online forums through ASCLS and by accessing my professional network through email and social networking sites for the University's MLS Alumni. A minimum of 30 participants was desired for the expert panel (Camillo, 2018).

Expert Panel Participants. There were 64 nominations and a total of 31 participants filled out the informed consent form. Table 1 presents a summary of the participants from Round One. Table 1 also includes the participant information for Rounds Two and Three, showing the attrition among each of the Rounds of data collection. The initial group of expert panel participants were located across the United States and represented experience in the profession from 12 years to over 40 years, with an average of 29 years of experience. Bench MLS professionals, supervisors, lead MLS, clinical coordinators, consultants, and educators were all represented in the group. Degrees and certifications included MLS, master's degrees, specialist certifications, and doctorates. Many times, individuals had more than one degree or certification associated with their qualifications as MLS experts. Of the 31 participants, only one was male, which is not surprising given the demographics of the profession, which is mostly female (Camillo, 2018).

Table 1

Description of MLS Expert Panel Participants for Round One, Round Two, and Round Three Data

<i>Round One Participant Data</i>		
# of Nominees	64	
# of Participants	31	
Gender	Female: 97% (30)	Male: 3% (1)
Years of Experience	Between 12 and 44	Average: 29 years
Degrees and Certifications	MLS/MT: 90% (28)	Masters: 32% (10)
	Specialist: 32% (10)	Doctorate: 26% (8)
Job Titles	Supervisor / manager	Educator / instructor
	Bench tech	Consultant
	Lead technologist	Clinical coordinator
<i>Round Two Participant Data</i>		
# of Participants	24 (22.6% attrition from Round One)	
Gender	Female: 96% (23)	Male: 4% (1)
Years of Experience	Between 12 and 44	Average: 29.5 years
Degrees and Certifications	MLS/MT: 83% (20)	Masters: 33% (8)
	Specialist: 33% (8)	Doctorate: 29% (7)
Job Titles	Supervisor / manager	Educator / instructor
	Bench tech	Consultant
	Lead technologist	Clinical coordinator
<i>Round Three Participant Data</i>		
# of Participants	19 (38.7% attrition from Round One; 20.8% attrition from Round Two)	
Gender	Female: 95% (18)	Male: 5% (1)
Years of Experience	Between 15 and 44	Average: 30.45 years
Degrees and Certifications	MLS/MT: 79% (15)	Masters: 32% (6)
	Specialist: 37% (7)	Doctorate: 37% (7)
Job Titles	Supervisor / manager	Educator / instructor
	Bench tech	Consultant
	Lead technologist	Clinical coordinator

Note. MLS – Medical Laboratory Science/Scientist; MT – Medical Technology/Technologist (previously used term for MLS)

Current Study

For the current study, the Delphi project that was initiated during the pilot study was first completed. Data collected with the Round Two survey were analyzed and, in conjunction with the data gathered during Round One, the Round Three survey was developed. The Round Three survey was sent out to the expert panel to further

consolidate ideas and consensus was attained for many of the identified practices. The Round Three survey data collection and analysis represented the completion of the Delphi project.

Based on the data collected and examined throughout the Delphi project, another survey was developed to send to a larger population of MLS professionals who were not included in the MLS expert panel. The intent of this survey was to determine the level of agreement between other MLS professionals and the expert panel regarding the identified disciplinary literacy practices of MLS, corroborating the findings of the Delphi project findings.

This additional survey also examined the participants' perceptions of their professional identity and sought to understand the disciplinary literacy practices that were common based on the participants' role in the laboratory. As previous studies have examined the professional identity of laboratory professionals (Beck & Doig, 2005, 2007; Doig & Beck, 2005), it was important to first understand perceptions of professional identity among the current participants. In addition, understanding these respondents' views on typical disciplinary literacy practices associated with specific roles in the profession, as well as perceptions of their own disciplinary literacy practices in relation to their role in the profession, were important in understanding the relationship between these two areas and how they are associated within the MLS profession.

Participants

MLS Experts Completing the Delphi Project. The expert panel of participants represents a continuation of the participants recruited from the pilot project (Camillo, 2018). Participant demographics for the Round Two survey are presented in Table 1

(p.66). There was a small amount of attrition between Round One and Round Two; seven participants did not respond to the request to participate in Round Two. In some cases, participants either retired or changed institutions and their contact information was no longer valid. In other cases, the reasons why participants did not respond remain unknown.

Participant demographics for the Round Three survey are also presented in Table 1. Once again, there was some attrition between Round Two and Round Three, and overall there was 35.5% attrition between Round One and Round Three. Between Round Two and Round Three, four participants did not respond to the request to participate in Round Three. Reasons why these participants did not respond are unknown, although the window of time to complete the Round Three survey was limited as compared to the first two rounds, and these four participants may not have been able to complete the survey within the allotted time. There were also partial responses/completions of the Round Three survey, which may have represented an initial attempt by some of the missing participants who did not complete the survey and input their name for acknowledgement.

MLS Practitioners. A larger population of MLS professionals was recruited from across the country and around the world using online forums through ASCLS, by accessing my professional network through email, and by accessing social networking sites for the University's MLS Alumni as well as other closed social network groups that were specifically focused on MLS professionals. Consent, demographic information, and responses to the additional survey were collected online, using survey software from Qualtrics. Table 2 provides information about the demographics of the MLS practitioners that participated in the MLS practitioner survey.

Table 2

Description of MLS Practitioner Participants

# of Participants (Experts Removed)	224	
Gender	Female: 84.8% (190) Prefer not to say: 2.7% (6)	Male: 12.1% (27) No response: 0.4% (1)
Race	American Indian or Alaska Native: 0.4% (1) Black or African American: 1.3% (3) White: 87.1% (195) Prefer not to say: 3.6% (8)	Asian: 3.1% (7) Hispanic or Latino/a: 3.1% (7) Other: 1.3% (3)
Years of Experience	0-5 years: 16.5% (37) 10-19 years: 19.2% (43) 30-39 years: 21.0% (47)	5-9 years: 12.1% (27) 20-29 years: 15.6% (35) 40+ years: 15.6% (35)
Degrees and Certifications <i>(Multiple responses could have been selected, % is out of participant total)</i>	MLT: 10.7% (24) MT/MLS: 65.6% (147) Categorical credential: 4.5% (10) Specialist credential: 10.3% (23) (ASCP): 74.6% (167) (AMT): 4.0% (9) (AAB): 2.2% (5) State license: 18.3% (41) Other: 3.1% (7) <i>Examples of Other: Toxicological Chemist (National Registry of Certified Chemists); BioMedical Scientist (UK); MT in Molecular Biology (ASCP); MT (HEW – U.S. Dept of Health, Education, Welfare; National Credentialing Agency for Lab Personnel (NCA), MASCP (Mastership awarded by the ASCP); DCLS Student</i>	Associate's Degree: 11.2% (25) Bachelor's Degree: 55.4% (124) Master's Degree: 29.9% (67) Doctoral Degree: 6.7% (15)
Facility / Organization Type	Hospital laboratory (100 beds or less): 14.2% (32) Hospital laboratory (101-250 beds): 15.2% (34) Hospital laboratory (251-500 beds): 18.8% (42) Hospital laboratory (501-750 beds): 8.9% (20) Hospital laboratory (>750 beds): 5.4% (12) <i>Total All Hospitals: 62.5% (140)</i> Other (define below): 8.5% (19) <i>Examples of Other: Public health laboratory, Laboratory equipment or instrument vendor, Software company, Cancer institute, Outpatient clinic, Traveling MLS, Integrated health system, and several indicated they were both in education and also the clinical setting.</i>	Consultant: 0.9% (2) Commercial Medical Reference Laboratory: 1.8% (4) Education: 20.1% (45) Industrial Laboratory: 0.4% (1) Instrument Technician or Sales: 0.4% (1) Private/Physician's Office Laboratory: 4.0% (9) Research Laboratory: 0.9% (2) No Response: 1 (0.4%)

Region and Community Type of Institution <i>(Multiple responses could have been selected, % is out of participant total)</i>	Northeast: 21.4% (49)	Midwest: 34.5% (79)	
	West: 12.7% (29)	South: 25.8% (59)	
	International: 3.5% (8)	No response, Region: 2.2% (5)	
	Urban: 20.6% (50)	Suburban: 10.3% (25)	
	Rural: 16.0% (39)	Military: 3.3% (8)	
	No response, Community: 49.8% (121)		
Job Descriptions	MLT	Supervisor / Manager	Specialist
	MT/MLS	Educator	Consultant
	Lead MT / MLS	Application Specialist	Coordinator
	Researcher	Project manager	

Note. MLS – Medical Laboratory Science/Scientist; MT – Medical Technology/Technologist (previously used term for MLS – baccalaureate degree); MLT – Medical Laboratory Technology/Technologist (associate degree).

The participants for the MLS practitioner survey had a wide range of time in the profession, from 0 to 40+ years of experience. They were also from a wide range of geographic locations, to include the entirety of the United States and internationally. The type of community that the participants served could not reliably be defined as nearly 50% of the participants did not indicate this information. There was also a range of education levels, certifications, and credentialing. This variety of background offered broad range of perspectives, both to consider the identified disciplinary literacy practices as well as sharing perceptions about the professional identity of MLS.

Other information obtained through the demographic information confirmed that the MLS profession is highly gendered, as 85% of the respondents identified as female. The demographics also demonstrate that the profession lacks diversity, as 87% of the respondents identified as white.

Data Gathering and Analysis

What follows is a general description of the data gathering and analysis methods that occurred for all surveys. More specific details for each data collection period are described in Chapters 4 and 5.

Data Collection

All survey responses were collected using the Qualtrics software platform. Data from the Round Two survey had been previously collected from the expert panel as part of the pilot project (Camillo, 2018), but had not been analyzed. The Round Three survey instrument and the MLS Practitioner survey were distributed either via email or using social media platforms, and each method of distribution provided a link to the applicable survey.

For the Delphi project surveys, which included Rounds Two and Three, there was a separate, but linked survey to collect the expert panel member's name in order to record participation while separating their responses from the identifying information. Email reminders were sent periodically to those members of the expert panel who had not participated in order to increase participation. The MLS Practitioner survey did not require this separation technique as the demographic data that was collected was not identifying and the survey was not designed to be one in a series. See Chapter 5 for more information.

Data Analysis

The responses for all surveys was downloaded from the Qualtrics website in an Excel format. Any extraneous data, such as language used, or any blank data columns, were removed from the file to make it easier to analyze, thus cleaning the file. The files

were uploaded into both the NVivo and SPSS software platforms. Each platform offered different methods for analysis of the data and are described below.

NVivo Analysis. For effectiveness of processing and coding the data, written responses from the comment boxes were organized in a Word document. A unique Word document was created for each survey associated with the individual rounds of the Delphi project as well as the practitioner survey. Each set, or block, of questions that were related to a principle disciplinary literacy category or theme was presented first along with the statistical analysis for each identified practice. Then the associated comment responses were listed below the block of questions. This way, the context for each response could be easily understood. This Word file was then uploaded to the NVivo software for coding. This was done in order to more efficiently code the responses and understand the context for each response.

Coding Methods. The first cycle of coding for all surveys was primarily In Vivo coding (Saldaña, 2016). This involved using the content and explanations that the participant provided in their response and a code was developed by the researcher, using the participants' own words. This yielded a long list of codes that required further analysis and consolidation.

The second cycle of coding followed a provisional coding method (Saldaña, 2016). The first cycle codes were compared with previously developed codes, either from the pilot project (Camillo, 2018) or from codes that were established during Rounds Two and Three, depending on the data or round that was being analyzed. Several codes had been developed during the pilot project and were then modified in each subsequent round. Initially, the codes had been divided up based on the primary category (reading,

writing, oral communication). These codes were then divided into secondary categories, represented by the primary findings from the pilot project. For instance, the code “Reading – Keeping Informed” represented the idea or theme that MLS read in order to stay informed. Sub-codes had also been established under each secondary category to provide further details and concepts of the finding, for instance “Reading – Keeping Informed – Reading to find a solution” represented the concept that reading sources in order to find a solution to a problem was part of staying informed in MLS. In Vivo codes that fit into the already established coding scheme were re-coded as appropriate.

If the first round code did not fit into an already established coding scheme, a third cycle of coding involved either pattern coding or elaborative coding methods (Saldaña, 2016). These methods were used to establish new codes based on repetition of codes in the first cycle of coding or to identify new concepts within the data. For instance, an elaborative code titled “Professional Identity” was developed in a top-down process when the data presented responses that related to the concept of professional identity. These coding methods further consolidated ideas in order to establish the disciplinary literacy practices of MLS and also connected the data to the primary concepts that were being examined: Disciplinary literacy and professional identity.

SPSS Analysis. The data files from Qualtrics were uploaded into SPSS software (Sweet & Grace-Martin, 2012). The data presented the agree-disagree Likert scale results, from Strongly agree to Strongly disagree. These values were transferred into numeric values, where Strongly agree received a numeric value of 5, Somewhat agree received a 4, Neither agree nor disagree received a 3, Somewhat disagree received a 2, and Strongly disagree received a score of 1. From this data, descriptive statistics,

primarily frequency distributions, could be evaluated, combining the 4 and 5 value as an overall Agree sentiment and the 1 and 2 values as an overall Disagree sentiment. The 3 value represented a neutral position.

For Round Three only, importance and frequency scale systems were used. The importance scale measured the participants' perception of how important the identified disciplinary literacy practice was to the MLS profession on 5 point scale from Absolutely essential to Not important at all. The frequency scale evaluated the participant's experience with how often each identified practice is typically performed in an average year, and was measured on a 6-point scale from Daily to Once a year. In both cases, the data were transferred into numeric values, where the more important or frequent were higher numbers and the less important or frequent were lower numbers. Zero was reserved for a non-response. Descriptive statistics, primarily frequency distributions, were evaluated based on this data.

Instrument Development

What follows is a general description of how the instruments were developed for Round Three of the Delphi project and for the MLS Practitioner survey. More specific details will be included in Chapters 4 and 5.

Round Three Instrument Development

The questions for the Round Three survey were developed after analysis of the Round Two data and a re-examination of information gathered from Round One. In addition, the literature was consulted to further consolidate ideas in an iterative process to reach a consensus. This survey also included questions related to the importance and frequency of each of the identified disciplinary literacy practices, which revealed which

practices are central to the profession as compared to those that are more peripheral. The third round survey had closed-answer questions with Likert-like scales (Fowler, 2014a). An added comment option was available to gather additional information that might be missed when using closed-questions only (Brill et al., 2007). This survey represented the final survey of the Delphi project and the last survey that was sent to the MLS expert panel.

MLS Practitioners Survey

Questions for this survey were developed based on the findings from all three Rounds of the Delphi project and through additional evaluation and consideration of the literature. The items that reached consensus among the members of the expert panel were presented to the general MLS population to determine if others in the profession agree with the findings from the expert panel, if there was an area of disagreement between the expert panel and the general population of MLS professionals, or if practices were not identified by the expert panel. In addition, questions related to professional identity, to include commitment to the profession, motivation to participate in continuing education, and the individual's perception of how other members of the healthcare team and the general public value the MLS profession were explored. This additional survey had closed-answer questions with Likert-like scales (Fowler, 2014a). As with previous surveys, an added comment option was available to gather any additional information that might be missed when using closed-questions only (Brill et al., 2007).

Prior to distributing each survey, cognitive interviews were conducted with a small group of MLS professionals (Fowler, 1995, 2014b). These volunteers reviewed the questions and overall organization of each survey to evaluate whether the questions

would be understood by the participants. Their feedback helped reduce researcher bias, and offered insights into clarifying questions to make them more comprehensible to the respondents (Fowler, 1995, 2014b).

Trustworthiness/Validity

According to Hasson et al. (2000), the reliability of the Delphi method has not been established; it has not been shown that multiple expert panels would each come up with the same answer to the problem or question. However, Hasson et al. (2000) suggests reliability is assured because there are many people involved with the development of the consensus and it is less likely that a large group of people will arrive at the wrong conclusion. Maxey and Kezar (2016) indicate that, for a classic Delphi study, the desired number of participants is between 30 to 60 experts. However, attrition over multiple rounds of data collection is a concern for maintaining the validity of the findings.

The additional survey provided further confirmation and validity of the findings from the expert panel. The incorporation of responses from other members of the MLS profession strengthens the findings by adding more individuals to the consensus. Additionally, this survey revealed practices that had not been identified by the expert panel, but were important to include in the list of disciplinary literacy practices.

When ideas are challenged through reasoned arguments, it helps to enhance validity (Hasson et al., 2000), though pressure to confirm will reduce validity. All of the surveys presented all ideas for consideration by the participants. Specific opinions from expert participants were not attributed to any one individual, so pressure to conform was minimized. Content validity comes from having experts on the panel who are interested

and have knowledge about the topic (Hasson et al., 2000). Concurrent validity comes from multiple rounds of data collection which leads to a consensus, though a low response rate will have a limiting effect (Hasson et al., 2000).

Limitations

The Delphi method is based on opinions rather than experimentation (Maxey & Kezar, 2016), which could be seen as a limitation for this study. However, devising an experiment to determine the actual disciplinary literacy practices that are occurring in the clinical setting would be difficult to create and generally impractical given the social construction of disciplinary literacy. The definition of an expert in MLS and the fact that a limited number of experts were nominated might affect the results as well (Maxey & Kezar, 2016). The experts who volunteered may not represent all members of the profession, and there are also concerns with attrition for the overall method (Maxey & Kezar, 2016). Selection of the experts was an important step in the process, and a high amount of attrition can be a limitation of this type of study.

The additional survey was incorporated to help enhance the findings from the expert panel and allowed others in the profession to express their views related to the identified disciplinary literacy practices of MLS. These participants were limited to those who had access to the Internet and who could be reached using the various resources that I also had access to, such as email, social networks, and professional online forums. It is likely that not all members of the population of MLS professionals were offered the chance to participate in this research, which is a limitation of this study.

Researcher bias in the wording of the questions and how they were interpreted by the participant were also potential limitations (Fowler, 2014e; Maxey & Kezar, 2016).

Cognitive interviews are one way of helping to reduce this bias (Fowler, 1995, 2014b). A small group of MLS volunteers reviewed each of the survey questions and provided feedback to determine if the questions were being understood in the way that was intended (Fowler, 1995, 2014b). Corrections to the questions were made prior to sending out the survey.

The sample frame for selection of the expert panel during the pilot study was limited to individuals in my professional network as well as those members of a professional association who opt in to the selected online communities, so some in the membership may not have been contacted. For the MLS Practitioner survey, these same resources were used, but other social networking groups specific to MLS professionals were also incorporated into recruiting participants in order to reach professionals who were not part of my professional network or professional associations, but who were practicing in the profession. All participants were encouraged to share the survey link with others, thus using a snowball method for sampling (Abbott, 2011). Professionals who were not connected to my professional network or who were not part of the professional association or the online social networks, unfortunately, were not part of the sample frame, contributing to sampling error in this study (Fowler, 2014e).

Participants were required to have access to the Internet as communication and surveys were conducted using online resources. This limited the sample frame to those who had access to the Internet, who were on social media sites, or who had email accounts that they checked on a regular basis (Fowler, 2014c, 2014d).

Ethical Considerations

Participation on the expert panel and filling out the MLS Practitioners survey was entirely voluntary. For the MLS expert panel, there was no direct link between participant identifiers and their responses due to the separation of surveys. For the MLS Practitioners, the type of questions that were asked were non-identifying and included demographics related to gender, race, time in the profession, occupation, description of their institution, and geographic description.

Confidentiality

For the Delphi project, two surveys were used in Rounds One, Two, and Three in order to maintain confidentiality. As part of the pilot project, informed consent, demographic information, and Round One responses were each gathered separately (Camillo, 2018). Separation of the surveys disassociated the participants' responses from their identifying information but provided contact information and a list of participants on the expert panel. These participants were contacted for both the Round Two and Round Three surveys, unless they had not responded to a previous survey.

During the Round Two and Round Three surveys, this two-survey method was used again. The respondents could answer the survey questions, and then they were linked to a separate survey so that they could record their name, and thus their participation, without a direct connection to their survey responses. Reminders were sent to just those participants who had not responded.

For the MLS Practitioners survey, this method was not necessary as the demographic information that was collected did not offer identifiable information about the participant. Instead, more general information about the participants and their

professional situation was collected. Information about the participant's gender was requested, as MLS has historically and consistently been a gendered profession with far more female professionals as compared to male professionals. The participant's race was also requested, as this is a part of the demographics of the profession that is not often discussed in the literature. Other information included more general information about the participant's professional scenario, such as the number of years they have been in the profession, their education and certification level in the profession (e.g. MLS, specialist, Bachelor's or Master's level, or beyond), a description of the type of institution where they work (e.g. hospital versus research or industry setting), and the description of their general geographic location and type of population they serve (e.g. urban versus rural, and the region within the U.S. versus international). These data were gathered in order to understand if any consistent variations in responses were detected based on this demographic information.

Conclusion

This study completed the Delphi process that began during the pilot project (Camillo, 2018). This research examined the data from the second round of data collection and also encompassed the third, and final round of the Delphi process. A consensus of the disciplinary literacy practices of MLS as defined by the MLS expert panel was attained. To verify the findings from the expert panel, a separate survey was sent to other MLS professionals. This survey also examined the professional identity of these MLS professionals and the relationship between professional identity and the identified disciplinary literacy practices from the MLS experts was explored. This study represents a unique perspective for the MLS profession, and may contribute to a

redefinition of the professional identity of MLS, providing a new perspective on the value of this profession to the healthcare team. Findings from this study could also provide a novel way to increase recruitment and retention of MLS professionals.

In order to have a clearer understanding of the different aspects of this study, two chapters of results are presented. The results for the final rounds of the Delphi project are presented in Chapter 4 and the results from the MLS Practitioner survey are presented in Chapter 5.

CHAPTER 4

RESULTS

Completion of Delphi Project with MLS Expert Panel

This chapter first describes the data analysis and results for the Round Two survey, which was collected after the pilot study was completed (Camillo, 2018). This survey was deployed over the summer of 2018 in order to maintain participation by the expert panel and to keep a consistent timeline for the Delphi project. Following the Round Two results will be a description of the development of the Round Three survey and the data analysis and results from this third, and final, survey of the Delphi project.

Round Two Data Analysis and Results

The Round Two data collected as part of the pilot project (Camillo, 2018) had to first be analyzed in order to develop the Round Three survey. The data were downloaded from the Qualtrics website, cleaned by removing any unnecessary data columns, and saved as an Excel file. The Excel file was uploaded into the SPSS software platform. Each platform offered different methods for analysis of the data. The free-text comments were copied into a Word document and were listed with each question block associated with each identified practice for context. This Word file was uploaded into NVivo for coding and qualitative data analysis.

SPSS Analysis. The uploaded data file presented the Likert scale results, from Strongly Agree to Strongly Disagree. The SPSS data needed to be transformed (Sweet & Grace-Martin, 2012), such that each point for the Likert scale was given a number where Strongly Disagree equaled 1 and Strongly Agree equaled 5. So agreement was associated with numbers 4 and 5 and disagreement included numbers 1 and 2. Number three was

neutral. Each of the question responses was transformed to include a column with numbers (1-5) corresponding to the text results (Strongly Disagree – Strongly Agree). From there, the descriptive statistics could be calculated and examined.

NVivo Analysis. For effectiveness of processing and coding the data, the written responses were organized in a Word document. Each of the question blocks was presented first for context, and included the statistical evaluation of the percent agreement/disagreement with each of the identified practices from the Round One survey. Following the question block, the comment responses were presented. This Word file was then uploaded to NVivo for coding.

Coding Methods. For the text comments, NVivo was used to code the data. The first round of coding was In Vivo coding (Saldaña, 2016), where the codes reflected the actual comments from the participants. Examples included “higher pay,” “blame,” and “background knowledge needed to troubleshoot.” In some cases, although the individual terms were slightly different, the codes were very similar to others. For example, under the reading category, one participant suggested reading involves “interpretation of subjective test results” while another believed that an MLS must read to “mentally standardize subjective test results.” It became clear there were similar concepts in the comments.

The second round of coding involved provisional coding (Saldaña, 2016), which incorporated the codes developed in the pilot project to see if the new comments fit under those previous codes. Many of the previous codes could be used for the new comments and a couple of new codes were also created, such as “complaints and problems” which

was added under the code for oral communication practices between the laboratory staff and clinical staff.

In addition to these codes, there were also some ‘crossover’ codes, which included the fact that reading and writing can happen via instruments. Previously, a “misc” code served as a catchall for items that seemed important, but that did not quite fit into the presented data. A “disciplinary literacy” code and a “professional identity” code were established, and many of the “misc” codes could be incorporated into these or their sub-codes. Disciplinary literacy included a sub-code related to making “implicit knowledge explicit” while professional identity included categories such as “lack of recognition” and “laboratory often blamed.” The data from Round One were revisited to determine if any of the new codes could be used for that data set and the “misc” code category was eventually removed as the data could be coded into these new categories. This step was important as it represents the iterative examination of all available data from the expert panel.

Round Two Results. Within the literature, there is not an established value for the level of agreement required for consensus, and it can range from 50% to 80% (Hasson et al., 2000). For this study, a percent of agreement of 75% or better was defined as the value that indicated consensus among the expert panel. This value was ascertained through descriptive statistical analyses via SPSS. Each practice was rated on a 5 point Likert scale. The percent of the total for each scale point was determined using SPSS. The percentages of both of the ‘agree’ points (Somewhat agree and Strongly agree) were combined for a total value to determine the level of overall agreement with

each stated practice and this was the value that determined the level of agreement among the MLS expert panel participants.

Disciplinary Literacy Practices That Reached Consensus. The statistical analyses of the Round Two data revealed that the majority of the identified disciplinary literacy practices for MLS achieved consensus among the panel of experts, most with well over 75% agreement. See Tables 3, 4, and 5 for the practices that reached consensus under reading, writing, and oral communication, respectively. Because of the high level of agreement, it was determined that consensus had been reached for these identified disciplinary literacy practices and they became part of the practices that were presented in the MLS practitioner survey. More information on the MLS practitioner survey and the subsequent data analysis may be found in Chapter 5.

Table 3

MLS Expert Panel Data Analysis. Round Two – Reading Practices that Reached Consensus, with Percent Agreement

Reading Practices in MLS Relate to Keeping Informed	% Agree
Reading in MLS is done to answer a question or solve a problem	95.83%
Reading in MLS is done to stay up to date on current issues in medicine, testing, and procedures	95.83%
Reading in MLS is done to learn about and review new technologies, products, or instruments	87.5%
Reading is done to prepare or remain knowledgeable in order to teach students and/or coworkers and others in healthcare	95.83%
Reading Practices in MLS Relate to Evaluation and Action	% Agree
Reading patient results requires interpretation and analysis of the results	95.83%
Using instruments, kits, or other reagents requires reading an instrument manual or product insert	91.67%
Reading standard operating procedures (SOPs) provides detailed information for performing tests and communicating results to clinical staff	95.83%
Quality control and calibration results must be read and evaluated prior to patient testing to confirm the test system is working appropriately and providing accurate results for patients	86.96%
When pre-analytical errors occur, when patient results are not consistent, or when instruments present errors, reading is done to troubleshoot the problem	91.67%
Manager or supervisor level MLS will read a variety of documents that may include budgets, personnel reports, and accreditation and regulatory documents	95.83%
Reading Practices in MLS Include Systems That do not Require Written Words (Semiotic Systems)	% Agree
Reading in MLS involves understanding auditory cues, such as timers, alarms, buzzers, etc.	87.5%
Reading in MLS involves interpretation of numbers and numerical values in a wide variety of contexts	100%
Reading in MLS involves visual analysis, which may include graphical representations	95.83%
Reading in MLS involves visual analysis, which may include images	95.83%
Reading in MLS involves visual analysis, which may include reading patient results that require interpretation of color changes, agglutination, colony formation and growth patterns on agar, cell morphology, stain results, etc.	95.83%
Visual analysis also includes interpretation of whether the results are correct or incorrect	100%
Reading Practices in MLS are Different Based on the Role of the MLS in the Laboratory	% Agree
Bench MLS professionals read in a limited and specific way	75%
Supervisor or management level MLS read in a broader way and read a wider variety of documentation	91.67%

Many of the identified reading practices achieved levels of agreement exceeding 90%. Each of the items that reached consensus was included in the MLS practitioner survey.

The final group of identified reading practices, related to the role of the MLS in the laboratory. It is essential to first understand that the laboratory has an established hierarchy among employees. The bench level MLS is typically tasked with performing patient sample testing. Lead MLS professionals perform patient testing, but they also have additional duties, such as reviewing quality control, writing SOPs for new test methods, and often they organize the work schedule for the employees within their department. Supervisors may oversee one or more department(s), and many times they are able to work on the bench when necessary. Laboratory Managers perform administrative duties that help keep the laboratory functioning appropriately.

This topic generated interesting comments from the MLS expert panel. Several participants indicated that there was not as much distinction in the reading practices between the bench MLS and supervisors. For example, one participant indicated:

Ideally there would be a difference in the reading for Bench MLS or Supervisor/Management level MLS, however, in practice, Bench MLS must have the ability to read in the manner of a supervisor/management level in the event of ineffective, or missing management/supervisory level staff in order to ensure patient safety.

This lack of distinction in reading practices between the bench MLS and supervisors prompted the development of a question for the Round Three survey seeking clarification on this topic from the MLS expert panel.

Table 4

MLS Expert Panel Data Analysis. Round Two – Writing Practices that Reached Consensus, with Percent Agreement

Writing Practices for the MLS Directed at an Audience Inside the Clinical Workplace Have Particular Purposes	% Agree
Writing in MLS is done to maintain a continuity of services.	83.33%
Writing in MLS is done to document a wide variety of things	95.83%
Writing in MLS is done to record patient results	83.33%
Writing of Standard Operating Procedures (SOPs) is done to provide a step-by-step process for running an instrument or test method	100%
Writing policies outlines the overall guidelines for the daily processes of the laboratory	95.83%
Writing orders enables the lab to purchase necessary supplies and equipment	83.33%
Writing in MLS is done to communicate with and between personnel.	100%
Writing Practices for the MLS That are Directed to an Audience Outside the Clinical Workplace also Have Particular Purposes	% Agree
In MLS, professional writing is done for other professionals outside of the clinical setting	79.17%
In MLS, writing for accreditation or regulatory bodies is done to meet the requirements to maintain accreditation and regulation	95.83%
In MLS, writing is done by MLS professionals and educators to convey information to students.	95.83%
Writing or Production Practices in MLS Relate to Systems That do not use Written Words (Semiotic Systems)	% Agree
Writing in MLS involves numbers associated with patient values and budgets.	100%
Writing in MLS involves visual representations, such as the production of diagrams, flow charts, graphs, etc. to convey information	87.5%
Writing in MLS involves visual representations, such as the production of images.	91.67%
Writing Practices in MLS are Different Based on the Role of the MLS in the Laboratory	% Agree
The writing done by bench MLS professionals has to do with entering patient results and maintaining continuity of service	95.83%
The writing done by supervisor or management level MLS is different and varied and may include budgets, personnel information, and accreditation documents	91.67%

All of the writing practices identified in Round One achieved consensus, many at greater than 90% agreement among the MLS expert panel in Round Two. As a level of agreement of $\geq 75\%$ had been identified as the value for determining the level of

consensus, all of the writing practices reached consensus, and thus all practices were included in the MLS practitioner survey.

Much like the reading practices and their relation to the role of the MLS, there were comments associated with the types of writing practices that certain MLS professionals may participate in, based on their role in the laboratory. In this case, there were conflicting comments. For example, one participant indicated “I do not see an overlap of the writing tasks for these different levels of staff as I did with the reading tasks.” However, another participant suggested “I think these lines are more blurred than ever.” In order to clarify this among the MLS expert panel, two questions were developed for the Round Three survey, to understand how the role of the MLS professional in the laboratory affects the types of reading and writing practices they use.

In addition, two new practices were identified through the comments provided by the experts. Two of the MLS experts suggested that, within the clinical workplace, there are certain writing functions that are conducted by the Laboratory Information System (LIS), the computer software that transmits patient laboratory results to their patient record for physicians and other caretakers to view. One participant proposed “In terms of patient resulting, results are sent through the LIS and released by the technologist, therefore, I wouldn't necessarily consider this as writing” while another said “[M]uch of these functions are automated so the ‘writing’ is done differently.” These comments suggested a new practice to explore with the MLS expert panel in Round Three, and a question related to this concept was added to the third round survey.

Another comment from one of the MLS experts related to writing practices directed to an audience outside of the clinical workplace. This expert wondered “[W]hat

about any writing for the general public?" This question prompted an additional practice to be included with the Round Three survey for consideration by the expert panel.

Table 5

MLS Expert Panel Data Analysis: Round Two – Oral Communication Practices that Reached Consensus, with Percent Agreement

Oral Communication Practices Occur Between Coworkers in the Laboratory	% Agree
Oral communication practices in MLS are done to maintain a continuity of service so that patient care continues seamlessly between shifts.	100%
Oral communication practices in MLS are done to communicate information about instruments and reagents.	100%
Oral communication practices in MLS are for problem solving.	100%
Oral communication practices in MLS are done for training.	100%
Oral communication practices in MLS are done between bench level MLS and supervisors/managers.	91.67%
Oral Communication Practices Occur Between the Laboratory Staff and Clinical Staff	% Agree
Oral communication practices in MLS are done to convey information.	100%
Oral communication practices in MLS are done to ask or answer questions.	91.67%
Oral Communication Practices Occur Between the Laboratory Staff and Others Associated with Healthcare	% Agree
Oral communication practices in MLS are associated with instrument maintenance, both inside and outside of the hospital.	91.67%
Oral communication practices in MLS are associated with other service providers	75%
Oral Communication Practices can be Associated with Education	% Agree
Oral communication practices in MLS are related to continuing education.	95.83%
Oral communication practices in MLS are related to presentations for others in healthcare, who are not MLS professionals	79.17%
Oral communication practices in MLS are related to teaching students, whether in the laboratory setting or in a classroom setting	100%

Many of the identified oral communication practices above achieved over 90% agreement with several reaching 100% agreement among the MLS expert panel. There were several identified practices within this group that did not achieve consensus, and those will be discussed below.

Additional practices were identified based on comments from the MLS expert panel. One point of clarification came in the form of understanding the types of communication that are common. Two experts indicated that much of the communication that happens in the laboratory is done using written means, such as email, rather than through oral communication. For example, one expert indicated, “in a large lab, a lot of communication is done by email, particularly with employees on different shifts” while another expert stated “electronic/written mechanisms may take over some of these - e-mail or texts.” This prompted the addition of a question related to this concept in the Round Three survey.

One MLS expert pointed out that often there are complaints that are exchanged between the laboratory staff and clinical staff, asking “[W]here does the issue of complaints about values, reports, etc. fit?” This question prompted two clarifying questions in the Round Three survey for the MLS expert panel to clarify if this is a unique practice, or whether it falls under an already established practice, such as conveying information.

Another practice identified by the MLS expert panel was the oral communication that happens between MLS professionals in the hospital laboratory and professionals working in reference or state laboratories. This expert wondered “[W]hat about oral [communication] with reference lab personnel - . If it was supposed to be included in the last [item] by inference [I] wish it would have been [stated].” This new practice was added to the Round Three survey for review by the MLS expert panel.

Finally, one MLS expert suggested that there was some crossover, or multimodality, of the disciplinary literacy practices, where teaching not only occurs in a

face-to-face setting, but also online, and therefore in a written context as well. This expert stated “teaching is largely oral but also posted online.” This concept was presented to the MLS expert panel in the Round Three survey for consideration.

Disciplinary Literacy Practices Not Reaching Consensus. Six practices identified in Round One and falling under oral communication did not reach consensus by the MLS expert panel. See Table 6. These practices were revisited in the Round Three survey to clarify further why they did not reach consensus.

Table 6

MLS Expert Panel Data Analysis: Round Two – Disciplinary Literacy Practices that Did Not Reach Consensus, with Percent Agreement (Threshold for Consensus $\geq 75\%$)

Oral Communication Practices Occur Between Coworkers in the Laboratory	% Agree
Oral communication practices in MLS relate to personal conversations between coworkers that do not relate to work-related topics	62.5%
Oral Communication Practices Occur Between the Laboratory Staff and Others Associated with Healthcare	% Agree
Oral communication practices in MLS are associated with administration of the hospital	58.33%
Oral communication practices in MLS are associated with environmental services in the hospital to maintain cleanliness and proper waste disposal	70.83%
Oral Communication Practices Occur Between the Laboratory Staff and Others Outside of Healthcare	% Agree
Oral communication practices in MLS are associated with patients	66.67%
Oral communication practices in MLS are associated with legislators, community members, donors, etc.	37.5%
Oral communication practices in MLS with others who are outside of healthcare is not typical	58.33%

Each of these practices did not reach the $\geq 75\%$ threshold for consensus and further refinement in order to understand these practices better was necessary.

Comments from the MLS expert panel were used to evaluate and modify the practices for the Round Three survey, and this process is described in the next section.

New Codes Developed from Round Two Data. Three new primary codes were developed from the Round Two data and included one related to “Disciplinary Literacy,” one associated with “Professional Identity,” and one that captured the “Crossover of Disciplinary Literacy Practices.” The “Disciplinary Literacy” and “Professional Identity” codes reflect the specific areas of interest for this research project.

Under “Disciplinary Literacy” two sub-codes were established; “Disciplinary Literacy – Didactic and Practice” and “Disciplinary Literacy – Implicit Knowledge Explicit.” The “Disciplinary Literacy – Didactic and Practice” code identified information presented by the experts that suggested concepts of acquisition and enculturation into the MLS profession. An example from one MLS expert, which was originally presented in the Round One responses, but had been re-examined in the Round Two data analyses was the following:

There are so many opportunities to show, tell students the nuances to our practice. I once had a student who struggled with the first stop/second stop on micropipettes. Very inconsistent. I could orally talk about it but until I placed my hand over hers on the pipette, she could not "feel" the subtle stops. This is a whole other topic about manipulating our tools!

This demonstrated the practice required during the didactic coursework and how important these steps are when teaching pre-professional MLS students.

There were two relevant examples that were categorized into the “Disciplinary Literacy – Implicit Knowledge Explicit” code, which was used to identify comments that related to making implicit knowledge of the profession explicit. Both of these comments were also presented during the Round One data collection, but were re-coded during the Round Two data analyses:

I think many educators jump from reading results to the second step of interpretation – the clinical correlation – without actually teaching

students how to think their way through data first. And it is because they are so facile at the first level of interpretation, they forget that students aren't.

Encouraging students to articulate what they did during the performance of a test, what they struggled with (providing a safe zone for failure), repeat procedure while orally explaining the process should build confidence and transfer into workplace practice. This attempts to make the implicit procedural knowledge explicit

Both comments support the idea that there are implicit practices in the profession that can be taught to students. The first comment suggests that educators may forget that students are still learning, and that steps that the educator automatically takes are not necessarily clear to a student. Keeping this in mind while teaching would be a good first step in making implicit knowledge explicit. The second comment suggests that students can participate in making tacit knowledge clear by talking through the steps of a procedure in order to understand it better, and recognize where they might be struggling.

The "Professional Identity" code was developed in order to begin the process of identifying information and ideas around the MLS professional identity. While questions related to this were not part of the surveys sent to the MLS expert panel, certain comments did express concerns, such as a lack of recognition and respect, which have been identified in the literature as contributing to the poor development of the MLS professional identity.

The "Crossover" code was important to note, as comment data from the participants often suggested a blending, or crossing over of the various disciplinary literacy practices. For instance, one MLS expert indicated "in a large lab, a lot of communication is done by email, particularly with employees on different shifts" in response to the oral communication practices that occur inside the clinical workplace. This suggests that, although oral communication happens, written communication also

occurs among coworkers. This was important to note in order to understand the multimodality of the disciplinary literacy practices of MLS.

Although there was some attrition (22.6% decrease in participation), the majority of the identified disciplinary literacy practices reached consensus in Round Two. These practices did not require further exploration or description from the MLS expert panel. However, understanding these practices in greater depth was warranted and questions related to these practices were included in the third round survey.

Round Three Instrument Development

There were four primary groupings of questions for the Round Three survey (see Appendix A). The first grouping related to those practices that did not reach consensus and required additional information in order to understand them more clearly. The second group of questions was associated with the practices that are affected by the role that the MLS professional plays in the laboratory setting. The third group presented new practices that had been identified through the comments provided by the MLS experts. The fourth group examined the disciplinary literacy practices that had reached consensus, and asked the MLS expert panel to evaluate their importance and frequency of use in the profession. The development of each grouping will be described.

Clarifying Disciplinary Literacy Practices that did Not Reach Consensus

Those practices that did not reach consensus (see Table 6) and the comments provided by the MLS expert panel participants were evaluated to determine whether the identified practice was inappropriate for the MLS profession, or if there was some additional piece of information that was missing from the disciplinary literacy practice.

The statement *Oral communication practices in MLS with others who are outside of healthcare is not typical* did not reach consensus (58% agreement), but there may have been confusion about this statement among the expert panel. Rather than being a specific disciplinary literacy practice, this statement was designed to be an exploratory question. Because there was a comment option provided for each survey, which would allow the participants to state an opinion such as ‘these practices are not typical,’ this particular statement was removed from the MLS practitioner survey.

The other practices required further elucidation from the MLS expert panel in order to understand why they did not reach consensus or to help refine the statement to better reflect the practice. Clarifying statements were incorporated into each of these identified practices to gather this additional information. These statements were based on comments from the MLS experts and will be described below.

Regarding personal conversations among MLS professionals, one expert submitted:

Personal conversations among bench MLS and between bench and supervisory MLS are important for building a team environment. However, this type of communication is not as essential and [*sic*] technical communications, especially in areas where this type of communication is culturally unfavorable.

Based on this comment, a clarifying statement (in italics) was included in the Round Three survey to determine whether or not this practice was truly part of the MLS disciplinary literacy practices, or not. The updated question read:

Oral communication practices in MLS relate to personal conversations between coworkers that do not relate to work-related topics. *These conversations may be important for team building, but may not be a core disciplinary literacy practice for MLS.*

This statement was presented to the MLS experts in the Round Three survey to determine their level of agreement with the modified practice.

The identified practice associated with hospital administration received three significant comments from the MLS expert panel. One expert indicated “In my practice, administration may relay messages to the staff, but rarely is there open communication between administration and MLS professionals.” In another example, the MLS expert suggested “[H]ospital administration [communication] is best conveyed in writing so that all personnel receive the same information.” Finally, another MLS expert submitted that “These will vary depending on one's position.” These comments led to several clarifying statements (*italics*) associated with this particular practice, and included the following:

Oral communication practices in MLS are associated with administration of the hospital including announcements, events, institutional information, etc.

- *This type of communication is conducted more in writing and not via oral communication.*
- *This type of communication is typically from the top-down and not generally a ‘conversation’ between laboratory staff and the administration.*
- *Open communication between laboratory staff and the administration depends on the role that the MLS has in the laboratory (e.g. only supervisors and/or managers participate in this type of communication).*

This practice was presented with each of these statements as individual questions for the MLS expert panel to review in the Round Three survey.

Although there were no specific comments related to the practice associated with environmental services, or the janitorial staff at a hospital, this practice did not reach consensus, though it was closer to 75% agreement compared to the other practices. In order to understand the responses further, the following clarifying statement (*italics*) was included in the practice statement as part of the Round Three survey:

Oral communication practices in MLS are associated with environmental services in the hospital to maintain cleanliness and proper waste disposal. *While an important task for maintaining the hospital laboratory environment, it is not a unique disciplinary literacy practice for MLS professionals.*

This statement was added in order to understand whether or not the MLS expert panel felt this was a unique practice to MLS, or one that is standard for any profession within a clinical setting.

The oral communication practice related to speaking with legislators, community members, or donors did not reach consensus. One MLS expert indicated:

I liked being able to indicate that though these communications modes are part of MLS, they are not typical. They occur more often through involvement with professional societies that have legislative advocacy OR, in the case of communities, may be part of institutional outreach, which is likely position specific.

This statement presented two different options for modifying the original practice statement, suggesting it is not a typical practice but that certain individuals may have opportunities to interact with these groups. The following clarifying statements (italics) were added to the original practice:

- Oral communication practices in MLS are associated with legislators, community members, donors, etc.
- *This is not something that most MLS professionals do consistently. These practices are more common for those MLS professionals who are members of professional societies that work on advocacy issues.*
 - *This practice depends on the role of the MLS profession (e.g. public outreach coordinator) and is not typical for most MLS professionals.*
 - *In an ideal world, it would be beneficial for MLS professionals to become involved in legislative issues and/or to make the profession known to the larger community.*

These additional statements served to gain a deeper understanding associated with this practice to determine whether or not it is a legitimate disciplinary literacy practice for MLS and whether it should be included in the MLS practitioner survey

Finally, the oral communication practice associated with speaking with patients did not reach consensus, but there were no comments submitted to help understand this result. In order to better understand this practice, a clarifying statement (*italics*) was added to the original statement:

Oral communication practices in MLS are associated with patients. May include instructions or explanations. *This is not something that most MLS professionals do consistently. However, in a perfect world – particularly with the advent of online health portals – it would be beneficial for patients to have access to laboratory professionals to understand their test results.*

This statement was designed to have the MLS expert panel consider not only what is occurring currently in the profession, but also to consider other possibilities and areas to enhance the professional identity of MLS.

The inclusion of these clarifying statements in the Round Three survey helped to further understand why the practices did not reach consensus or to determine whether the identified practice was not a unique practice for MLS. These were rated on a 5 point agree-disagree Likert scale.

The Role of the MLS Professional and the Effect on Disciplinary Literacy Practices

The second group of questions developed for the Round Three survey were associated with how the role of the MLS professional may affect the type of practices that are used. Specifically, the questions asked the MLS experts whether or not they felt that there really was a distinction between the required reading and writing practices of bench MLS as compared to supervisors. Several MLS experts suggested that there was not as much of a distinction between the reading and writing that is expected of bench MLS when compared to supervisors or managers;

Ideally there would be a difference in the reading for Bench MLS or Supervisor/Management level MLS, however, in practice, Bench MLS

must have the ability to read in the manner of a supervisor/management level in the event of ineffective, or missing management/supervisory level staff in order to ensure patient safety.

These results from the Round Two survey suggested that both reading and writing practices were less discrete and not based on the laboratory hierarchy, and this was supported by other experts. For instance, one expert stated “although I agree with these statement[s], some reading should be the same - professional journals and other forms of professional development, SOPs, as examples.” Due to these findings, the question presented in the Round Three survey combined both reading and writing. This question was evaluated on a 5 point agree-disagree Likert scale.

New Disciplinary Literacy Practices

Comments provided by the MLS expert panel participants in Round Two identified some new practices. As the design of the Delphi method is to take all ideas and then present them for consideration to the expert panel, these practices were presented to the group for evaluation.

Two new writing practices were identified. One related to the writing performed in the clinical workplace, and had to do with the laboratory information system (LIS). One MLS expert indicated “In terms of patient resulting, results are sent through the LIS and released by the technologist, therefore, I wouldn't necessarily consider this as writing.” This concept was presented to the MLS expert panel to determine if they agreed that some of these writing practices are not part of the disciplinary literacy of MLS.

The other writing practice had to do with writing done to communicate to those outside of the clinical setting. Specifically, one MLS expert asked “what about any

writing for the general public?” The writing practice for conveying information to the general public was added to the Round Three survey to determine how much the experts agreed with that practice.

Several new practices associated with oral communication were added. Two practices related to the oral communication between laboratory and clinical staff. One MLS expert asked “where does the issue of complaints about values, reports, etc. fit?” The two previously identified practices in this category related to asking or answering questions and conveying information to the clinical staff. Responding to complaints could be seen as conveying information. So the new practice was presented, and a follow up question was asked about whether this would fit under conveying information.

Another MLS expert suggested that, rather than oral communication, “electronic/written mechanisms may take over some of these – e-mail or texts.” So a new practice was incorporated suggesting that asking and answering questions and conveying information to the clinical staff is done via written methods.

One new practice was identified for the oral communication practices that occur between the laboratory staff and others associated with healthcare. An MLS expert asked “what about oral [communication] with reference lab personnel?” This practice was included in the Round Three survey for evaluation by the expert panel.

The last new practice concerned oral communication practices and education. One of the experts pointed out that “teaching is largely oral but also posted online.” This suggested the multimodality of disciplinary literacy practices, especially oral communication (recorded presentation) and writing (PowerPoint presentation).

Each of these practices were added to the Round Three survey and they were rated by the MLS experts on a 5 point agree-disagree Likert scale.

Importance and Frequency of Disciplinary Literacy Practices Reaching Consensus

Finally, those practices in each of the three main areas of disciplinary literacy (reading, writing, oral communication) that reached consensus in Round Two were modified slightly in order to understand how important the MLS experts felt each practice was to the profession. This was rated on a 5 point Likert scale of importance, from Absolutely essential to Not important at all. In addition, the statements related to the practices were modified in order to understand how frequently each of the identified practices occur in an average year. This was evaluated by the MLS expert panel using a 6 point frequency Likert scale, from Daily to Once a year. These questions were included in the survey to gain a greater understanding about these practices and to recognize the core practices in the profession, as compared to some of the other, less important or less frequently used practices. As was the case for the Round Two survey, an added comment option was available to gather additional information that might have been missed when using closed-questions only (Brill et al., 2007).

Prior to sending the Round Three survey to the expert panel, a cognitive interview session was performed with a small group of MLS professionals. The feedback they provided helped to refine the survey to make it understandable for the expert panel. Although it was a long survey, those participating in the cognitive interview indicated that it was necessary. Once complete, the Round Three survey was sent to the expert panel, with a timeline of five weeks to take the survey. This deadline allowed enough time for the experts to take the survey while keeping the timeline reasonable for

collecting and analyzing the data from the Round Three survey. It also provided the necessary period in the schedule for preparing the fourth and final survey, which was distributed to a larger population of laboratory practitioners.

Round Three Data Analysis

The Round Three data were downloaded from the Qualtrics website, cleaned by removing any unnecessary data columns, and saved as an Excel file. The Excel file was uploaded into the SPSS software platform. As was done with the Round Two comments, the Round Three comments were copied into a Word document and were listed with the statistical analyses associated with each question block for context. Separate Word documents were used for each major grouping of questions, which included the items that did not reach consensus, new practices, further clarification on how the role of the MLS affects their disciplinary literacy practices, and the importance and frequency evaluation of the items that did reach consensus in Round Two. These Word files were uploaded into NVivo for coding and qualitative data analysis.

SPSS Analysis

The uploaded data file presented three different Likert scales, including an agree-disagree scale, an importance scale, and a frequency scale. For each type of scale, the SPSS data needed to be transformed (Sweet & Grace-Martin, 2012). The agree-disagree Likert scale was transformed as was described for the Round Two data.

The importance scale ranged from Absolutely essential to Not important at all. Not important at all was given a value of 1 and Absolutely essential was given a value of 5. An important practice was rated using with numbers 4 and 5 while practices that were deemed unimportant were rated at a 1 and 2. Number three was neutral.

The frequency scale was a 6 point Likert scale and had a range from Daily to Once a year. This scale was not evaluated for levels of frequency, but observed to consider the level of variability identified by the MLS expert panel. This scale also caused confusion among the expert panel, as some participants indicated that frequency was difficult to determine at times, or that specific examples of practices were grouped together such that one specific practice may have been done frequently, while another was not. Once transformed, the frequency statistics could be evaluated for each of the three scales.

NVivo Analysis

For effectiveness of processing and coding the data, the written responses were organized in separate Word documents based on the question grouping, from the items that did not reach consensus to those responses that did reach consensus in Round Two for which the level of importance and frequency of use were being examined. In each file, the question statistics and histograms were presented first for context. When applicable, the values that could be combined (level of agreement or importance of the practice) were presented in a new column within the data. Following the series of questions in each block, the comment responses were presented. This Word file was then uploaded to NVivo for coding.

Coding Methods. The first round of coding was In Vivo coding (Saldaña, 2016), where the codes reflected the actual comments from the participants. Examples included “blue remarks were confusing,” “depends on interest,” and “may never happen in a career.” In some cases, although the individual terms were slightly different, some codes were very similar to others. For example, there were a couple of codes associated with

frequency of the practice that considered the role of the MLS professional; “Example of roles where frequency can be different” and “Frequency depends on the person.” As with the Round Two data, there were similar concepts revealed in the comments.

The second round of coding involved provisional coding (Saldaña, 2016), which incorporated the codes developed both in the pilot project and during the Round Two data analysis to see if the new comments fit under those previous codes. Many of the previous codes could be used for the new comments. There were some new codes that were created, such as a “Miscellaneous” code that was used to identify items that did not fit under the other codes, but was used for information that seemed important to note. Examples of these codes include one that related to the confusion that participants expressed, “Misc – Questions are confusing or items should not be grouped together.” This was a prominent code for the questions related to the frequency of identified practices. There was also a “Misc – Examples provided” code, used when respondents provided specific examples in their response to a particular question block.

When considering the practices that did not reach consensus, clarification statements were added to the base statements, and depending on the responses from the MLS expert panel, some practices were removed from the list of possibilities that would be sent to the MLS practitioners. A code was established to indicate the particular practices that were removed from inclusion in the MLS practitioner survey, in order to maintain the data within the coding scheme. These included codes that, based on the responses from the MLS expert panel, were determined to not be core practices of the MLS profession. Further details are outlined below.

The concept of Professional Identity was also expanded using new codes, based on comments from the MLS experts. These included the idea that professional identity may be affected by the role that the MLS professional plays in the laboratory and also the type of institution where they are employed (large versus small hospital). This was an area where further exploration, based on the responses from the MLS practitioners, would prove enlightening.

Partial Responses

Data collected during the final, Round Three survey with the MLS expert panel presented some challenges for data collection. There were a total of 28 responses downloaded from Qualtrics. Of those, four had no data associated with them, and were thus eliminated from evaluation. An additional five responses were incomplete, that is, the participant had not responded to all of the questions and had not been redirected to the separate demographic (name) collection survey. Because of the incomplete nature of these five responses, they were removed from the analysis of the data, leaving a total of 19 complete responses for data analysis. These partial responses may have represented all of the invited participants, or they could have represented duplicate data, depending on whether the respondent had started their response using another computer.

The 19 full responses represented a 38.7% attrition rate from the Round One participants, and a 20.8% attrition from the Round Two survey. Since the majority of the identified practices reached consensus during Round Two, these additional data helped clarify confusion associated with those items that did not reach consensus and confirmation, or not, as it relates to new practices that were identified in Round Two.

Round Three Results

The following results represent the data from the 19 full responses and do not include the data from the partial responses that were submitted. Comments provided in the partial responses were reviewed to determine whether they were consistent with the data, but were not included in the analysis.

Clarifying Statements for Practices that did not Reach Consensus

Based on the items that did not reach consensus in the Round Two survey, follow up or clarifying statements were included with these practices. See Table 7 for the level of agreement among the MLS expert panel.

Table 7

MLS Expert Panel Data Analysis: Round Three – Disciplinary Literacy Practices that Did Not Reach Consensus in Round Two, with Clarifying Statement and Percent Agreement (Threshold for Consensus $\geq 75\%$)

Oral communication practices occur between coworkers in the laboratory:	% Agree
Oral communication practices in MLS relate to personal conversations between coworkers that do not relate to work-related topics. <i>These conversations may be important for team building, but may not be a core disciplinary literacy practice for MLS.</i>	89.5%
Oral communication practices in MLS are associated with administration of the hospital including announcements, events, institutional information, etc. <i>This type of communication is conducted more in writing and not via oral communication.</i>	94.7%
Oral communication practices in MLS are associated with administration of the hospital including announcements, events, institutional information, etc. <i>This type of communication is typically from the top-down and not generally a 'conversation' between laboratory staff and the administration.</i>	84.2%
Oral communication practices in MLS are associated with administration of the hospital including announcements, events, institutional information, etc. <i>Open communication between laboratory staff and the administration depends on the role that the MLS has in the laboratory (e.g. only supervisors and/or managers participate in this type of communication).</i>	84.2%
Oral communication practices in MLS are associated with environmental services in the hospital to maintain cleanliness and proper waste disposal. <i>While an important task for maintaining the hospital laboratory environment, it is not a unique disciplinary literacy practice for MLS professionals.</i>	84.2%

<p>Oral communication practices in MLS are associated with patients. May include instructions or explanations.</p> <p><i>This is not something that most MLS professionals do consistently. However, in a perfect world – particularly with the advent of online health portals – it would be beneficial for patients to have access to laboratory professionals to understand their test results.</i></p>	<p>68.4% (No Consensus)</p>
<p>Oral communication practices in MLS are associated with legislators, community members, donors, etc.</p> <p><i>This is not something that most MLS professionals do consistently. These practices are more common for those MLS professionals who are members of professional societies that work on advocacy issues.</i></p>	<p>84.3%</p>
<p>Oral communication practices in MLS are associated with legislators, community members, donors, etc.</p> <p><i>This practice depends on the role of the MLS profession (e.g. public outreach coordinator) and is not typical for most MLS professionals.</i></p>	<p>84.2%</p>
<p>Oral communication practices in MLS are associated with legislators, community members, donors, etc.</p> <p><i>In an ideal world, it would be beneficial for MLS professionals to become involved in legislative issues and/or to make the profession known to the larger community.</i></p>	<p>89.5%</p>

Based on the level of agreement from the MLS expert panel with the clarifying statements, several practices that had been identified in Round One needed to be removed from the MLS practitioner survey and were not included in the final list of disciplinary literacy practices of MLS. For example, the oral communication practice associated with personal conversations between coworkers was determined to be important for team building, but these conversations were not considered a core disciplinary literacy practice for MLS. This practice was removed because there was consensus associated with the clarifying comment.

This same concept was true for the oral communication practices associated with administration of the hospital and environmental services and these questions were removed from the MLS practitioner survey. However, there was consensus around the idea that communicating with hospital administration varies depending on the role that

the MLS professional plays in their institution. One MLS expert discussed this idea in detail:

While one question asks about the laboratory personnel interacting with hospital administrators via oral communication, I feel that the type and format of communication is dependent on a larger number of factors. In some aspects, alerting hospital administration of an emergency situation... may be dependent on role or shift, and while (hopefully) not the most common communication with administration, it would commonly commence in the form of verbal communication from a typical MLS. Other communication such as the availability of a new test or replacement of a new test or protocol may take the form of bottom-up communication in both oral and written format and is more likely performed by those in supervisory/management roles but is a common form of essential communication all hospital laboratories would engage in with administration.

Because of this comment, a question was added to the MLS practitioner survey to determine how much agreement there was with this idea.

The MLS experts indicated agreement with the clarifying statements associated with oral communication with legislators, community members, donors, etc. One MLS expert was specific about which group is most likely to be part of the practices, indicating “oral communication with community members occurs more frequently than with legislators and donors. When someone finds out you are a medical professional (not unique to MLS), they will often ask advice about a condition, or tell you their experiences.” These items were incorporated into the MLS practitioner survey. In addition, there was a question associated with how the role of the MLS professional affects these types of interactions, and a question was included in the MLS practitioner survey to reflect that consensus.

Although the question that asked the MLS expert panel to consider the oral communication practices associated with patients did not reach consensus, this practice

was kept on the MLS practitioner survey in order to understand whether this is a common practice, or not. One MLS expert highlighted why this practice should be included by stating:

It would be very beneficial to have a patient laboratory advocate to sit and explain results. I do consulting on the side, and most patients are completely oblivious as to what their lab results mean, and what has even been tested.

It may be that this is a common practice, and the item was included in the MLS practitioner survey to better understand how predominant it is within the larger population of MLS professionals.

New Disciplinary Literacy Practices to Understand

The Round Two survey revealed several new disciplinary literacy practices associated with writing and oral communication that were presented to the MLS experts for their evaluation of merit. See Table 8 for the results.

Table 8

MLS Expert Panel Data Analysis: Round Three – New Disciplinary Literacy Practices to Understand, with Percent Agreement (Threshold for Consensus $\geq 75\%$)

Writing practices in MLS directed at an audience inside the clinical workplace have particular purposes	% Agree
The laboratory information system (LIS) performs some of the identified writing practices (e.g. autoverification), and therefore these are not part of the typical disciplinary literacy practices of MLS	42.1% (<i>No Consensus</i>)
Writing practices in MLS that are directed to an audience outside the clinical workplace also have particular purposes	% Agree
In MLS, writing is done by MLS professionals and educators to convey information to the general public.	78.9%
Oral communication practices occur between the laboratory staff and clinical staff	% Agree
Oral communication practices in MLS are done to convey concerns about patient reports or values.	89.4%
Oral communication practices that convey concerns about patient reports or values could be considered part of conveying information	94.7%
Many of these oral communication practices, such as conveying information or asking/answering questions is done via written means (email, etc.)	47.42% (<i>No Consensus</i>)
Oral communication practices occur between the laboratory staff and others associated with healthcare:	% Agree
Oral communication practices in MLS are associated with reference and state laboratories.	89.4%
Oral communication practices can be associated with education:	% Agree
Continuing education and teaching students can also be presented online (in a written format, or perhaps a recorded presentation) and are not strictly done using oral communication practices.	78.9%

Based on these responses, the new practice identified during Round Two associated with the LIS replacing disciplinary literacy practices of MLS did not reach consensus, and therefore was not included in the MLS practitioner survey. As one MLS expert indicated “While the LIS is an invaluable tool, the MLS has to be ‘literate’ in LIS functions in order to operate effectively when the LIS is down, and to recognize when the LIS is not operating correctly.” This expert indicates that the writing practices are not being replaced, but suggests the LIS is a tool to help convey the information. Another

MLS expert suggested “a human defines the autoverification parameters.” So while the writing is helped by the LIS, it is controlled and designed by the MLS professional.

The writing practice associated with writing for the general public did reach consensus, and was included in the MLS practitioner survey. One MLS expert indicated that “within the educator arena, it is more likely the program director that is responsible for conveying information to the general public.” However another expert suggested “MLS writing is not generally for the general public but rather for internal purposes such as new or updated SOPs, case presentations to staff, research findings from new instrument evaluations or ongoing studies.” This practice was kept as part of the MLS practitioner survey and will help clarify if this is a practice that occurs among the larger population of MLS professionals, or not.

There was consensus associated with the oral communication practices related to reference and state laboratories and how some educational practices are not only done in person, but also online, and therefore cross over into written practices. For one MLS expert, there was a distinction between different types of teaching and they suggested “Continuing education should be separated from teaching students. Of course continuing [education] is delivered online. Teaching students can be in various formats, however, oral communication is important in the internship.” Both of these items were added to the MLS practitioner survey.

Crossover, or multimodal, practices related to communicating with others associated with healthcare using both oral and written methods did not reach consensus. One MLS expert stated “I don't think that oral communications are conducted in writing. Rather I would agree, in part, that communication... with clinical staff about patients

(questions and concerns) occurs both in writing and orally.” Another expert suggested “some communication regarding patient results is done orally between MLS in the lab... communication with other health care professionals is generally split between oral and email.” While these two experts agreed that this practice can be conducted both orally and written, most did not or were unsure, so the practice was not included in the MLS practitioner survey.

During Round Two, an expert indicated that there should be a practice associated with conveying concerns about patient reports or values. This question was asked of the MLS experts in Round Three, but also asked whether this type of practice should be included under conveying information. Both items reached consensus, and this prompted an editing of this practice for the MLS practitioner survey under oral communication practices to include these concerns as part of the examples related to the oral communication practice that conveys information to others associated with healthcare.

Understanding how the Role of the MLS Affects Disciplinary Literacy Practices

The Round Three survey presented questions to better understand and clarify how the role that the MLS professional plays in the workplace affects the types of disciplinary literacy practices that are performed. The suggestion from Round Two was that there is less distinction between bench MLS professionals and supervisors and managers. See Table 9 for the MLS expert panel evaluation.

Table 9

MLS Expert Panel Data Analysis: Round Three – Disciplinary Literacy Practices as They Relate to the Role of the MLS Professional, with Percent Agreement (Threshold for Consensus $\geq 75\%$)

Reading practices and writing practices in MLS are different based on the role of the MLS in the laboratory	% Agree
There is a lot of overlap between the bench and the supervisor. Supervisors have to be able to read and write the same things as the bench MLS professionals.	84.2%
There is a lot of overlap between the bench and the supervisor. Many bench MLS professionals are reading and writing the same things that the supervisors must read and write.	47.4% (<i>No Consensus</i>)

Given these results, the MLS experts felt that supervisors need to be able to read and write the same texts as compared to the bench MLS professional, but there was disagreement when it came to the bench MLS reading and writing the same types of documents as a supervisor. Several MLS experts commented on these particular practices. Two experts suggested that they felt there was more distinction between supervisory level practices and bench level practices. One expert stated “In my experience, bench technologists infrequently are involved in budgets, scheduling, [and] billing” while the other expert indicated:

I think the suggestion that "bench" staff... read what managers do because the institution puts them in a supervisory/managerial role without the title or recognition means that in fact they are not "bench" staff any more. So, the question then becomes, are those tasks part of the role of bench staff - broadly. I would say, probably not.

Another expert hinted at more stratification of the roles, where bench level MLS may have limited reading and writing practices, while more experienced MLS professionals take on more assignments:

Bench techs may be assigned a set of procedures, SOP, instrument [evaluations] that they are responsible to update and enter into the document control process for reviews and signatures. That has been an

expectation for years. Lead MLS most likely has input into daily task assignments, possible inventory and usage in regard to budget

In contrast, another MLS expert suggested that this lack of distinction between the roles was essential for developing and advancing professionals within an institution:

In the effective labs I have worked in there is a great deal of cross over [*sic*] between the roles, the reading and writing of bench techs and supervisors. Unless you have some of this crossover, how do you find and train new supervisory personnel.

These multimodal practices, and how they are affected by the role of the MLS professional, are important to explore in order to understand what is being done in the clinical setting. The questions were incorporated into the MLS practitioner survey to understand what other professionals are doing on a day-to-day basis.

Importance and Frequency of Practices that Reached Consensus

In the Round Two survey, several identified practices reached consensus among the MLS expert panel. In Round Three, the MLS experts were asked to consider how important they felt the practices were and, considering an average year, how often the practices are typically performed. This was done to understand whether frequency and importance of the practices are connected, or if there are important practices that are performed infrequently.

Reading Practices that Reached Consensus. The perception of importance and frequency were evaluated for the reading practices that reached consensus. See Table 10 for the level of importance associated with these practices and the frequency that the MLS experts felt was appropriate for each practice.

Table 10

MLS Expert Panel Data Analysis: Round Three – Reading Practices that Reached Consensus, Importance and Frequency Data

Reading Practices in MLS Relate to Keeping Informed		Level of Importance
Reading in MLS is done to answer a question or solve a problem		100%
	Frequency	
	<i>Monthly</i>	21.1%
	<i>Weekly</i>	21.1%
	<i>Daily</i>	57.9%
Reading in MLS is done to stay up to date on current issues in medicine, testing, and procedures		89.5%
	Frequency	
	<i>Once a year</i>	5.3%
	<i>Every six months</i>	15.8%
	<i>Quarterly</i>	10.5%
	<i>Monthly</i>	31.6%
	<i>Weekly</i>	31.6%
	<i>Daily</i>	5.3%
Reading in MLS is done to learn about and review new technologies, products, or instruments		79%
	Frequency	
	<i>No response</i>	12.5%
	<i>Once a year</i>	16.7%
	<i>Every six months</i>	12.5%
	<i>Quarterly</i>	4.2%
	<i>Monthly</i>	50%
	<i>Daily</i>	4.2%
Reading is done to prepare or remain knowledgeable in order to teach students and/or coworkers and others in healthcare		89.5%
	Frequency	
	<i>Once a year</i>	15.8%
	<i>Every six months</i>	21.1%
	<i>Monthly</i>	36.8%
	<i>Weekly</i>	15.8%
	<i>Daily</i>	10.5%
Reading Practices in MLS Relate to Evaluation and Action		Level of Importance
Reading patient results requires interpretation and analysis of the results		100%
	Frequency	
	<i>Daily</i>	100%
Using instruments, kits, or other reagents requires reading an instrument manual or product insert		100%
	Frequency	
	<i>No response</i>	5.3%
	<i>Once a year</i>	5.3%
	<i>Every six months</i>	10.5%
	<i>Quarterly</i>	5.3%
	<i>Monthly</i>	31.6%
	<i>Weekly</i>	26.3%
	<i>Daily</i>	15.8%

Reading standard operating procedures (SOPs) provides detailed information for performing tests and communicating results to clinical staff	100%
	Frequency
<i>Once a year</i>	10.5%
<i>Every six months</i>	10.5%
<i>Quarterly</i>	10.5%
<i>Monthly</i>	10.5%
<i>Weekly</i>	26.3%
<i>Daily</i>	31.6%
Quality control and calibration results must be read and evaluated prior to patient testing to confirm the test system is working appropriately and providing accurate results for patients	100%
	Frequency
<i>Monthly</i>	5.3%
<i>Weekly</i>	10.5%
<i>Daily</i>	84.2%
When pre-analytical errors occur, when patient results are not consistent, or when instruments present errors, reading is done to troubleshoot the problem	100%
	Frequency
<i>No response</i>	5.3%
<i>Weekly</i>	52.6%
<i>Daily</i>	42.1%
Manager or supervisor level MLS will read a variety of documents that may include budgets, personnel reports, and accreditation and regulatory documents	94.7%
Budgets	Frequency
<i>No response</i>	10.5%
<i>Once a year</i>	15.8%
<i>Every six months</i>	5.3%
<i>Quarterly</i>	21.1%
<i>Monthly</i>	26.3%
<i>Weekly</i>	21.1%
Personnel reports	Frequency
<i>No response</i>	5.3%
<i>Once a year</i>	15.8%
<i>Every six months</i>	10.5%
<i>Quarterly</i>	26.3%
<i>Monthly</i>	26.3%
<i>Weekly</i>	15.8%
Accreditation and regulatory documents	Frequency
<i>No response</i>	5.3%
<i>Once a year</i>	10.5%
<i>Every six months</i>	36.8%
<i>Quarterly</i>	15.8%
<i>Monthly</i>	15.8%
<i>Weekly</i>	15.8%
Reading Practices in MLS Include Systems That do not Require Written Words (Semiotic Systems)	Level of Importance
Reading in MLS involves understanding auditory cues, such as timers, alarms, buzzers, etc.	94.8%
	Frequency
<i>Weekly</i>	5.3%
<i>Daily</i>	94.7%

Reading in MLS involves interpretation of numbers and numerical values in a wide variety of contexts.		100%
	Frequency	
	<i>Daily</i>	100%
Reading in MLS involves visual analysis, which may include graphical representations.		100%
	Frequency	
	<i>Weekly</i>	21.1%
	<i>Daily</i>	78.9%
Reading in MLS involves visual analysis, which may include images.		100%
	Frequency	
	<i>Weekly</i>	15.8%
	<i>Daily</i>	84.2%
Reading in MLS involves visual analysis, which may include reading patient results that require interpretation of color changes, agglutination, colony formation and growth patterns on agar, cell morphology, stain results, etc.		100%
	Frequency	
	<i>Daily</i>	100%
Visual analysis also includes interpretation of whether the results are correct or incorrect.		100%
	Frequency	
	<i>Daily</i>	100%

All of the identified reading practices were determined to be important by the MLS expert panel. The established value of 75% was used to determine consensus for the level of importance of each practice. The frequency of each practice varied. In some cases, the primary activities of MLS professionals, such as interpreting color changes, agglutination, colony formation, and whether the results made sense are performed on a daily basis. This makes sense, given that these are primary activities of MLS professionals.

The other practices showed a range of frequencies. This may have had to do with the idea that some of these activities are dependent on the role that the MLS has in the laboratory. One MLS expert suggested this by saying “again hard to generalize but reading is very important to lab personnel at all levels, probably more so at the level of supervisors/leads/educators in the lab.” Another MLS expert presented this idea in a different way:

The answer to these is also dependent on what one's specific MLS role is in the laboratory. If it is part of your job to inform others about new instruments, new techniques, or if one has responsibilities in an educational program then the answer to the last question is daily. If [your] job is to run as many [chemistry] panels through [an] instrument as one can in [a] day, then the answer is different.

Thus, frequency was difficult to determine as the specific role was not outlined in the question.

One MLS expert did make an interesting comment related to the reading of auditory cues and mentioned another type of reading practice that can occur in the laboratory:

I agree that laboratory professionals need to interpret the meaning of auditory cues (so I answered strongly agree), but is that reading??? At the same time, deaf laboratorians need to be accommodated with visual substitutes (e.g. flashing lights). And while deafness can be accommodated, blindness cannot.

The concept of using lights to cue hearing impaired individuals was one that had not been mentioned previously, but is a valid point as with audio cues. These visual cues help the hearing impaired MLS professional know when timers are going off or when the phone is ringing and accommodations can be made in the laboratory. However, this expert points out that the profession cannot accommodate blind individuals, as many results and interpretations are made by viewing color changes, colonies on an agar plate, or cells under a microscope. These interpretations require visual interpretations.

Writing Practices that Reached Consensus. The perception of importance and frequency were evaluated for the writing practices that reached consensus. See Table 11 for the level of importance associated with these practices and the frequency that the MLS experts felt was appropriate for each practice.

Table 11

MLS Expert Panel Data Analysis: Round Three – Writing Practices that Reached Consensus, Importance and Frequency Data

Writing Practices for the MLS Directed at an Audience Inside the Clinical Workplace Have Particular Purposes	Level of Importance
Writing in MLS is done to maintain a continuity of services.	94.7%
	Frequency
<i>Quarterly</i>	5.3%
<i>Monthly</i>	5.3%
<i>Weekly</i>	10.5%
<i>Daily</i>	78.9%
Writing in MLS is done to document a wide variety of things	100%
	Frequency
<i>Weekly</i>	5.3%
<i>Daily</i>	94.7%
Writing in MLS is done to record patient results	100%
	Frequency
<i>Daily</i>	100%
Writing of Standard Operating Procedures (SOPs) is done to provide a step-by-step process for running an instrument or test method	100%
	Frequency
<i>Once a year</i>	31.6%
<i>Every six months</i>	15.8%
<i>Quarterly</i>	15.8%
<i>Monthly</i>	21.1%
<i>Weekly</i>	10.5%
<i>Daily</i>	5.3%
Writing policies outlines the overall guidelines for the daily processes of the laboratory	94.8%
	Frequency
<i>Once a year</i>	31.6%
<i>Every six months</i>	15.8%
<i>Quarterly</i>	26.3%
<i>Monthly</i>	10.5%
<i>Weekly</i>	5.3%
<i>Daily</i>	10.5%
Writing orders enables the lab to purchase necessary supplies and equipment	78.9%
	Frequency
<i>Once a year</i>	5.3%
<i>Quarterly</i>	5.3%
<i>Monthly</i>	36.8%
<i>Weekly</i>	42.1%
<i>Daily</i>	10.5%
Writing in MLS is done to communicate with and between personnel.	89.5%
	Frequency
<i>Every six months</i>	5.3%
<i>Monthly</i>	5.3%
<i>Weekly</i>	26.3%
<i>Daily</i>	63.2%

Writing Practices for the MLS That are Directed to an Audience Outside the Clinical Workplace also Have Particular Purposes	Level of Importance
In MLS, professional writing is done for other professionals outside of the clinical setting	52.6% (<i>Not important</i>)
	Frequency
<i>No response</i>	10.5%
<i>Once a year</i>	57.9%
<i>Every six months</i>	5.3%
<i>Quarterly</i>	15.8%
<i>Monthly</i>	10.5%
In MLS, writing for accreditation or regulatory bodies is done to meet the requirements to maintain accreditation and regulation	94.8%
	Frequency
<i>No response</i>	10.5%
<i>Once a year</i>	52.6%
<i>Every six months</i>	10.5%
<i>Quarterly</i>	15.8%
<i>Monthly</i>	5.3%
<i>Weekly</i>	5.3%
In MLS, writing is done by MLS professionals and educators to convey information to students.	84.2%
	Frequency
<i>No response</i>	10.5%
<i>Once a year</i>	5.3%
<i>Every six months</i>	15.8%
<i>Quarterly</i>	5.3%
<i>Monthly</i>	15.8%
<i>Weekly</i>	15.8%
<i>Daily</i>	31.6%
Writing or Production Practices in MLS Relate to Systems That do not use Written Words (Semiotic Systems)	Level of Importance
Writing in MLS involves numbers associated with patient values and budgets.	100%
	Frequency
<i>Monthly</i>	5.3%
<i>Daily</i>	94.7%
Writing in MLS involves visual representations, such as the production of diagrams, flow charts, graphs, etc. to convey information	84.2%
	Frequency
<i>Once a year</i>	15.8%
<i>Every six months</i>	5.3%
<i>Quarterly</i>	5.3%
<i>Monthly</i>	21.1%
<i>Weekly</i>	21.1%
<i>Daily</i>	31.6%
Writing in MLS involves visual representations, such as the production of images.	78.9%
	Frequency
<i>Once a year</i>	21.1%
<i>Every six months</i>	5.3%
<i>Quarterly</i>	10.5%
<i>Monthly</i>	15.8%
<i>Weekly</i>	21.1%
<i>Daily</i>	26.3%

All but one of the writing practices identified was considered important by the MLS expert panel. The practice that did not reach the 75% threshold for level of importance related to writing that is done for other professionals outside of the clinical laboratory. One MLS expert indicated “[W]riting for other professionals and accreditation is done when required or when there is time.” So while this was an identified practice, its importance in the profession seems diminished.

The role that the MLS plays in the laboratory was also a prominent consideration for the actual practices and for how often they are performed. One MLS expert suggested that working in a more computerized laboratory affects the frequency of writing:

In a computerized laboratory, some writing declines...the instrument prints the calibration and control results. [Here], the specification about managers [versus] staff would be helpful. Staff may never write an SOP, policy, [or] purchase order. So, for those, I am thinking about managers.

Another concern expressed by some of the experts had to do with the difficulty in assigning frequencies. This was expressed by one MLS expert when they stated:

It becomes difficult to respond to these statements. Are you referring to one individual? For example, ‘write Standard Operating Procedures (SOPs)’ might be done as infrequently as an annual basis for a smaller facility, but more frequently for a large lab rapidly adding new procedures. The review of the procedures, however, would be ongoing.

This difficulty was also expressed by another MLS expert, who felt that there should have been an option for the practice to not be present: “There should have been a never button for the last set of questions.” While this individual may be speaking about their own experience, these practices were identified and deemed important in previous rounds, so it stands to reason that they are practiced some place, even if it is infrequent.

Overall, the frequency of these practices varied, except for the practice of recording patient results, which is performed daily. Writing numbers, often the format

for reporting patient results, was also listed as being done mostly daily. This makes sense as this is a primary function of the MLS profession.

Oral Communication Practices Reaching Consensus. The perception of importance and frequency were evaluated for the oral communication practices that reached consensus. See Table 12 for the level of importance associated with these practices and the frequency that the MLS experts felt was appropriate for each practice.

Table 12

MLS Expert Panel Data Analysis: Round Three – Oral Communication Practices that Reached Consensus, Importance and Frequency Data

Oral Communication Practices Occur Between Coworkers in the Laboratory	Level of Importance
Oral communication practices in MLS is done to maintain a continuity of service so that patient care continues seamlessly between shifts.	100%
	Frequency
	<i>Quarterly</i> 5.3%
	<i>Daily</i> 94.7%
Oral communication practices in MLS are done to communicate information about instruments and reagents.	94.8%
	Frequency
	<i>Weekly</i> 15.8%
	<i>Daily</i> 84.2%
Oral communication practices in MLS are for problem solving.	100%
	Frequency
	<i>Weekly</i> 5.3%
	<i>Daily</i> 94.7%
Oral communication practices in MLS are done for training.	100%
	Frequency
	<i>No response</i> 5.3%
	<i>Once a year</i> 10.5%
	<i>Every six months</i> 5.3%
	<i>Quarterly</i> 5.3%
	<i>Monthly</i> 15.8%
	<i>Weekly</i> 5.3%
	<i>Daily</i> 52.6%
Oral communication practices in MLS are done between bench level MLS and supervisors/managers.	100%
	Frequency
	<i>No response</i> 5.3%
	<i>Quarterly</i> 5.3%
	<i>Monthly</i> 5.3%
	<i>Weekly</i> 15.8%
	<i>Daily</i> 68.4%

Oral Communication Practices Occur Between the Laboratory Staff and Clinical Staff	Level of Importance
Oral communication practices in MLS are done to convey information.	100%
	Frequency
	<i>Weekly</i> 5.3%
	<i>Daily</i> 94.7%
Oral communication practices in MLS are done to ask or answer questions.	100%
	Frequency
	<i>Weekly</i> 21.1%
	<i>Daily</i> 78.9%
Oral Communication Practices Occur Between the Laboratory Staff and Others Associated with Healthcare	Level of Importance
Oral communication practices in MLS are associated with instrument maintenance, both inside and outside of the hospital.	94.8%
	Frequency
	<i>No response</i> 5.3%
	<i>Quarterly</i> 10.5%
	<i>Monthly</i> 15.8%
	<i>Weekly</i> 36.8%
	<i>Daily</i> 31.6%
Oral communication practices in MLS are associated with other service providers	78.9%
	Frequency
	<i>No response</i> 5.3%
	<i>Once a year</i> 5.3%
	<i>Monthly</i> 5.3%
	<i>Weekly</i> 31.6%
	<i>Daily</i> 52.6%
Oral communication practices in MLS are associated with reference and state laboratories	79%
	Frequency
	<i>No response</i> 5.3%
	<i>Once a year</i> 5.3%
	<i>Every six months</i> 5.3%
	<i>Quarterly</i> 5.3%
	<i>Monthly</i> 5.3%
	<i>Weekly</i> 42.1%
	<i>Daily</i> 31.6%
Oral Communication Practices can be Associated with Education	Level of Importance
Oral communication practices in MLS are related to continuing education.	78.9%
	Frequency
	<i>No response</i> 5.3%
	<i>Once a year</i> 10.5%
	<i>Every six months</i> 15.8%
	<i>Quarterly</i> 10.5%
	<i>Monthly</i> 26.3%
	<i>Weekly</i> 26.3%
	<i>Daily</i> 5.3%

Oral communication practices in MLS are related to presentations for others in healthcare, who are not MLS professionals	73.7% (<i>Not important</i>)
	Frequency
<i>No response</i>	5.3%
<i>Once a year</i>	21.1%
<i>Every six months</i>	15.8%
<i>Quarterly</i>	10.5%
<i>Monthly</i>	26.3%
<i>Weekly</i>	15.8%
<i>Daily</i>	5.3%
Oral communication practices in MLS are related to teaching students, whether in the laboratory setting or in a classroom setting	94.7%
	Frequency
<i>No response</i>	5.3%
<i>Every six months</i>	5.3%
<i>Quarterly</i>	10.5%
<i>Monthly</i>	10.5%
<i>Weekly</i>	15.8%
<i>Daily</i>	52.6%

For oral communication practices, all but one of the practices were above the 75% threshold for importance and were considered to be important practices. The one that did not reach this level was very close (73.7%) and related to presentations given to those who are part of healthcare, but are not MLS professionals. One MLS expert suggested that this practice may be dependent on the role of the MLS professional, but also a personal interest:

Providing education is variable depending on position type and interest. We do expect all bench staff to teach students, but continuing education and presentation to other healthcare providers is not expected unless someone identifies themselves as wanting to participate. I would like to see MLS be more comfortable and encouraged to participate in giving presentations as I find most shy away from this opportunity.

This expert did express that they wished more MLS professionals would give presentations, but that many times, they prefer not to.

Interestingly, the variability in the frequency that particular practices are performed, as identified by the expert panel, was related to the group of people that the communication was between. Oral communication between coworkers and the clinical

staff were considered virtually daily practices. One MLS expert stated “we should be talking all the time - particularly at shift change to assure a continuity of care.” Since coworkers and clinical staff are important parts of the healthcare team in taking care of patients and providing accurate results, this makes sense. There was some variability concerning training and communications with supervisors. One MLS expert suggested:

[M]ost bench training is done orally and one on one but employees also need to read SOPS and stay abreast of procedural changes by reading.
[S]upervisors have quarterly staff meetings on a regular basis to communicate departmental information BUT employees not present need to read minutes.

This expert mentions not only oral communication, but also writing and reading practices, reinforcing the multimodalities of the disciplinary literacy of the profession.

Several MLS experts expressed that these oral communication practices could be quite variable, depending on the institution and the laboratory professional. One MLS expert stated “probably varies from lab to lab and among individuals, hard to generalize,” while another stated “this varies a lot and hard to generalize the frequency.” In one case, the MLS expert indicated that they did not respond to some of the frequency questions and left a comment indicating “Those unanswered will vary by facility.” This applied to the practices that showed a wide variability as it related to frequency of how often the practice occurs.

Effect of Partial Responses

Those partial responses that included comments were generally in agreement with the MLS experts who completed the survey. The level of agreement, importance, and the frequency values for all identified practices were consistent and similar between the full responses and when reviewing the partial responses.

Conclusion

The MLS practitioner survey was shaped by the responses to the Round Three questions. The practices that required clarification statements were either added or removed from the practitioner survey, depending on the response to the additional statement. The clarifying statements were maintained in the MLS practitioner survey for consistency.

Questions associated with the role of the MLS were considered to be related to the professional identity and the questions were associated with how an individual's role in their workplace affects the practices with which they participate. In order to understand what MLS practitioners do in their own institution, questions were incorporated into the MLS practitioner survey to evaluate this and understand this aspect of the MLS professional identity.

The new practices that were identified and included in the Round Three survey had been presented to the MLS expert panel to determine whether they should be included in the MLS practitioner survey, or not; those that reached consensus were included in the survey.

Overall, the disciplinary literacy practices that had been identified in Round One and reached consensus in Round Two were considered important practices by the MLS expert panel. The frequency of how often those practices were performed, however, varied. The reason for the variability had to do with confusion over the different roles that an MLS professional can play in the clinical setting, and may also be affected by the type of facility and the interest of the professional.

The Round Three survey distribution and analysis represented the completion of the Delphi project. Several disciplinary literacy practices identified in Round One and Round Two reached consensus among the MLS expert panel. These represent the core disciplinary literacy practices of the MLS profession. In order to enhance the consistency and trustworthiness of the findings from this Delphi project, a separate survey was developed and distributed to a wider population of laboratory professionals to determine the level of agreement with the identified practices. This survey also offered an opportunity for new disciplinary literacy practices to be identified using comment boxes or possibly detect discrepancies between the two groups of respondents. The MLS practitioner survey offered a way to enhance the findings from the Delphi project and add more support to the overall findings of this research project.

CHAPTER 5

RESULTS

MLS Practitioner Survey

This chapter first describes the development of the MLS practitioner survey, which was modified from both the Round Two and Three surveys that had been sent to the expert panel. Following this description is an analysis of the results from this survey. The purpose of this additional survey, which was influenced by, but not part of, the Delphi project was to either add further verification and validity to the Delphi project findings, reveal discrepancies between the expert panel and practitioners, and/or identify previously unidentified practices.

MLS Practitioner Instrument Development

In order to develop the MLS practitioner survey (see Appendix B), the statistical evaluation from the Delphi project had to be completed. For a full description of this process and the findings from the Delphi project, see Chapter 4. Questions for the MLS practitioner survey were questions that had previously been presented to the MLS expert panel. They were taken either taken directly or slightly modified from questions that had previously been developed for the surveys in Rounds Two and Three of the Delphi project. An explanation of which questions came from each survey is described below.

Questions from the Delphi Round Two Survey

Several items reached consensus among the expert panel during Round Two. They covered each category of disciplinary literacy practice: reading, writing, and oral communication. These items were included in the MLS practitioner survey just as they had been presented to the expert panel. There was one exception to this and had to do

with the questions that asked about the specific types of disciplinary literacy practices related to a particular role in the clinical setting. In the Round Two survey, there were two questions that asked about specific practices (e.g. reading and writing) that are conducted by bench MLS professionals compared to a supervisor or management level professional. For reading, one question stated “bench MLS professionals read in a limited and specific way” and for writing the related question indicated “the writing done by bench MLS professionals has to do with entering patient results and maintaining continuity of service.” Slightly different questions were asked as they related to supervisors or managers. Both sets of questions, as they pertained to the reading and writing practices of bench MLS and supervisor MLS, reached consensus among the expert panel. However, there were several comments provided by the experts that suggested these divisions were not as stark as these questions suggested, so new questions were developed for the Round Three survey to help understand these comments.

For the MLS practitioner survey, the questions presented in the Round Two survey were posed to the practitioners, but they were combined into one statement, for instance: “Bench MLS professionals read and write in limited and specific ways. e.g. reading and writing test results, SOPs, and information to maintain a continuity of service, etc.” In addition, the two questions asking about the lack of distinction between the bench and supervisor practices that was presented in the Round Three survey were also posed to the practitioners, even though one did not reach consensus. The following statement did not reach consensus by the expert panel:

There is a lot of overlap between the bench and the supervisor. Many bench MLS professionals are reading and writing the same things that the

supervisors must read and write (budgets, schedules, SOPs, instrument evaluations, billing, etc.). This may be because of short staffing issues, or because of their position (e.g. lead MLS) in the laboratory.

However, because the MLS practitioner survey was going out to a wide variety of MLS professionals, this question offered an opportunity to understand whether the larger population, with their varied experiences and settings, agreed with this concept, or not.

Questions from the Delphi Round Three Survey

The Round Three survey presented six new practices as identified by the expert panel in the Round Two survey comments. A question to simplify a particular practice was also included and it was determined that the new practice could actually be included in an already established practice. Of the other five new practices, three reached consensus. In addition, nine questions with clarifying statements were also included in the Round Three survey. These were evaluated to determine if they should be included, or not, in the MLS practitioner survey.

New Practices. Of the six new practices identified in the Round Two survey, four reached consensus among the expert panel in Round Three. One of those new practices reaching consensus included a question to simplify the practice:

Oral communication practices in MLS are done to convey concerns about patient reports or values. *(Clarifying) Oral communication practices that convey concerns about patient reports or values could be considered part of conveying information.*

The consensus obtained by the expert panel for this question led to a modification of the examples provided in a previously identified practice under the oral communication practices that occur between the laboratory staff and clinical staff. This modified version of the practice was included in the MLS practitioner survey.

Three other practices, related to both writing and oral communication practices, reached consensus and were included in the MLS practitioner survey while two new practices did not reach consensus, and were not included in the MLS practitioner survey.

Practices with Clarifying Statements. Of the nine questions that included clarifying statements presented to the expert panel in the Round Three survey, all but one reached consensus. In some cases, the clarifying statements (*italics*) asked the expert panel members to consider whether the identified practice was actually a distinct disciplinary literacy practice for MLS, for instance:

Oral communication practices in MLS relate to personal conversations between coworkers that do not relate to work-related topics. *These conversations may be important for team building, but may not be a core disciplinary literacy practice for MLS.*

Although this comment reached consensus among the expert panel, that consensus meant that this particular item would be removed from the MLS practitioner survey. The agreement was with the statement that this was not a core disciplinary literacy practice of MLS.

Similarly, a series of clarifying statements associated with the administration of the hospital resulted in the removal of the questions associated with this practice, except as they relate to the role of the MLS professional in the clinical setting. However, the questions with clarifying statements associated with oral communication practices associated with legislators, community members, and donors reached consensus among the expert panel and they were included, along with the clarifying statement, in the MLS practitioner survey.

One practice that included a clarifying statement (*italics*) that did not reach consensus among the expert panel related to oral communication with patients:

Oral communication practices in MLS are associated with patients. May include instructions or explanations. *This is not something that most MLS professionals do consistently. However, in a perfect world – particularly with the advent of online health portals – it would be beneficial for patients to have access to laboratory professionals to understand their test results.*

Although this did not reach consensus among the experts, this question was included in the MLS practitioner survey as a way to understand the value that MLS professionals place upon their own knowledge as part of their professional identity.

Questions Related to Professional Identity

In addition to the disciplinary literacy practices identified by the expert panel during the Delphi project, questions relating to professional identity were included in the MLS practitioner survey. These questions were modified from previous studies that have examined areas of professional identity to include empowerment and retention in a profession (Doig & Beck, 2005; Short & Rinehart, 1992). In order to keep the survey a reasonable length, only 14 statements were identified for the MLS practitioners to consider.

Demographic Questions

In order to understand the respondent's experience in the profession, their education level, certification type, the type and location of their institution, and job description, several questions were incorporated into the MLS practitioner survey to capture these demographics.

Education and Certification. Because education levels, specialties, and certifications can vary, a list of possible options were included in the survey and the respondent had the option to choose more than one. For example, the respondent could have indicated that they had a Bachelor's degree, an MLS/MT certification, and was

certified through ASCP. There was also a comment box that allowed the respondent to indicate a specialty, certification, or degree that was not listed in the options.

Institution Type and Location. In order to understand the type of institution where the respondent worked, a list of possible options was presented in the survey and included hospitals of varying sizes, education settings, research, physician's office laboratories, and others. There was also a comment option in case the respondent's institution type was not represented in the predefined list. The respondents could only choose one option. In addition, geographic location – including the northeast, Midwest, and international – and community settings – including urban, suburban, or rural – were also presented in one question, and the respondent could choose more than one option.

Gender, Race, and Length of Time in Profession. In addition to the above, the respondents were asked to identify their gender and race, with an option not to respond, so that a general understanding of the profession could be evaluated. It is well established that the MLS profession is highly gendered (Kotlarz, 1998b, 1998e), so this question sought to confirm the current status of the profession. The literature associated with the MLS profession does not address race, so including this demographic information was designed to illuminate the racial makeup of laboratory professionals. To understand the span of experience of the respondents, a question was included in the survey that asked about how long they had been in the profession, from newly graduated to those with 40 or more years of experience. Having representation from all levels of experience provided diverse perspectives.

Survey Design and Data Collection

As was the case for the Round Two and Round Three surveys that were part of the Delphi project, the practices and professional identity statements presented in the MLS practitioner survey were rated on agree-disagree 5 point Likert scales (Fowler, 2014a), from Strongly agree to Strongly disagree. Just as was done with Rounds Two and Three of the Delphi project, an added comment option was available to gather any additional thoughts or insights that might be missed when using closed-questions only (Brill et al., 2007).

The MLS practitioner survey was presented and data collected using the online survey platform, Qualtrics. Prior to distributing the MLS practitioner survey, a cognitive interview session was performed with a small group of MLS professionals. The feedback they provided helped to refine the survey to make it understandable for the MLS practitioners. The introductory information was modified such that it provided important information to the MLS practitioners, but was slightly shorter than the explanatory information presented to the expert panel. Even with this change, there were still several blocks of questions for the MLS practitioners to consider and respond to, making the survey lengthy overall. Those participating in the cognitive interview indicated that, although it was a long survey, this was necessary in order to obtain the information needed for this project.

Once the cognitive interview process was complete, the survey link was distributed to a variety of resources which included the same sources that were used to recruit MLS experts for the Delphi project. These included professional online forums through ASCLS and my professional network. In addition, closed groups on social

media sites with a focus on MLS were also employed in order to reach a greater number of MLS professionals from a wide variety of institutions, experiences, and locations. The timeline for data collection was three weeks, with periodic reminders sent over that time. This deadline kept the data collection on track for the final analysis and completion of this dissertation project.

Determination of Data for MLS Practitioner Survey Analysis

Once the survey was closed, there were a total of 491 responses, though most of these were incomplete and not usable for this study. Only 232 responses were considered complete and useable for this study while the other 259 responses either had no response associated with them and represented a click-in to the survey only, or were partially completed. These responses were removed from the MLS practitioner data. One respondent that had a 'complete' survey, as defined by Qualtrics, indicated that they did not want to participate in the study and this response was also removed.

Removing Expert Responses

Because this survey went out to the same sources as had been used for the Delphi project, there was a possibility that some of the experts would also respond to the MLS practitioner survey. To determine which responses were connected to the expert panel, a question was included in this survey that asked if the respondent had participated as an expert on the expert panel. There were 11 respondents that answered yes to this question and these responses were removed from the practitioner responses so that each data set represented two distinct groups of participants.

Upon closer inspection of the respondents that indicated they had participated as a member of the expert panel, it became evident that some who responded with a "yes"

were not actually members of the expert panel. For example, one respondent indicated he had 10-19 years of experience and identified his position as an ‘application specialist.’ However, the only male participant on the expert panel had 40+ years of experience and worked in education. This discovery led to a close inspection of each of the 11 responses and it was determined that there were three respondents who had incorrectly identified themselves as participating on the expert panel. The other eight responses were removed, and the three were included in the MLS practitioner data set. This resulted in a total of 224 responses that were used for analysis.

MLS Practitioners Survey Data Analysis

Data analysis for the MLS practitioner survey was conducted in much the same manner as was done in Rounds Two and Three of the Delphi project. Responses were downloaded from the Qualtrics website in an Excel format. Ordinal values were uploaded and also transformed into numeric values using SPSS software (Sweet & Grace-Martin, 2012). The free-text responses were organized by the question group and incorporated into a Word document that was uploaded into the NVivo software platform for qualitative data analysis.

Some additional questions were asked in this survey, and offered the respondents the opportunity to choose multiple answers to two questions related to their own experience and the disciplinary literacy practices they perform in their role at their institution. The analysis of those questions was conducted using Excel as they could not easily be analyzed using SPSS or NVivo.

SPSS Analysis

The Excel file from Qualtrics included agree-disagree Likert scale results, from Strongly Agree to Strongly Disagree. This data needed to be transformed (Sweet & Grace-Martin, 2012), such that each point for the Likert scale was given a number where Strongly Disagree equaled 1 and Strongly Agree equaled 5. In addition, a further transformation and consolidation of these values was also performed so that agreement was associated with numbers 4 and 5 and disagreement included numbers 1 and 2. Number 3 was neutral. From there, the descriptive statistics could be calculated and examined. Statistical analyses included the frequencies and level of agreement for each identified disciplinary literacy practice as well as each statement related to professional identity.

Comparison of Experts and Practitioners

For this survey, the practitioner responses were not only examined as a group, but they were also compared to responses from the experts using the 3 point values for agreement or disagreement. These responses were compared using the frequency values to determine the level of agreement with a particular statement.

Using classical statistical tests, such as chi-squared or *t* tests, on the two data sets proved challenging due to the large difference in the number of participants between the two groups and data that did not fit a normal distribution. Because of these differences, an alternate way of comparing the two groups was devised. The mean values between each group of respondents, using the numeric 5 point Likert scale, was compared to determine the amount of deviation in levels of agreement between each group. The practitioner mean was subtracted from the expert mean, such that a negative value would

suggest the practitioners more strongly agreed with a statement as compared to the experts and a positive value would suggest the experts had stronger agreement with a practice. The closer the deviation value was to zero, the more closely both groups agreed with the statement.

For a full understanding of the data and a more complete comparison between the groups, both the percent agreement between the experts and practitioners and the mean deviation are presented.

NVivo Analysis

For effectiveness of processing and coding the data, the written comment responses were first organized in a Word document. Each of the question blocks and frequency data was presented, and then the comment responses were listed below the block with which they were connected. This way, the context for each response could be easily understood. This Word file was then uploaded to NVivo for coding. This was done in order to more efficiently code the responses.

Coding Methods. The first cycle of coding was primarily In Vivo coding (Saldaña, 2016). This involved reading the different responses and coding based on the content and explanations that the participant provided in their response. Comments for both the disciplinary literacy practices and professional identity questions were coded in this manner. In some cases, the In Vivo codes were analogous because the terms used by the MLS practitioners were similar. For example, under the oral communication category, one participant suggested that “oral communication is followed up by written to avoid misunderstanding” while another indicated “oral communication followed by written communication for documentation.” There were many codes that were developed

through this method, but it helped to see the respondents' own words initially. It should be noted that one participant responded to the prompt question "Do you have any additional thoughts or comments related to the above practices?" with "No" and these comments were not coded as they were merely a response to the question.

The second round of coding involved provisional coding (Saldaña, 2016), which incorporated the previously identified codes developed during the Delphi project to see if the new comments fit under those codes. Many of the previously identified codes could be used for the new comments. For example, the above comments would fall not only under "oral communication" but also "crossover of disciplinary literacy practices" since both oral communication and written communication were identified by the respondent for the same task. These comments supported the multimodality of the disciplinary literacy practices of MLS.

In relation to professional identity, several new codes were created and required a pattern coding (Saldaña, 2016) strategy, rather than provisional coding. While provisional coding is useful when codes have already been established, in this case there was only one previously developed code – "Professional Identity" – that had been created. In order to find the connections between the In Vivo codes associated with professional identity, pattern coding was used as this method is designed to find these relationships, consolidating ideas into larger themes. One example was that there were several comments that related to the respondents' perception of the profession, both positive and negative, and these comments were categorized into "Professional Identity – Personal Perceptions of the Profession." In addition, there were a number of comments that did not fit under any category and were identified under a "Miscellaneous" code.

This kept the comments in the data set, but they could not be categorized easily into the other codes. Examples include commentary about the questions “answers are obvious,” or comments that these are “important practices,” or one participant’s observation that “spelling is important.” These codes were categorized under miscellaneous and required revisiting during a third round of coding.

A third round of coding employed axial and elaborative coding (Saldaña, 2016) to examine the miscellaneous and professional identity codes to see where and how they relate to other codes or if new, consolidated codes made better sense. These methods also considered findings from the literature. In one case, a previous code, “Professional Identity – Do Not Question Physicians” was reevaluated and changed to indicate “Professional Identity – Defer to Physicians and Pathologists” as responses from all data sources that had been coded this way reflected information from the literature that suggested MLS professionals continue to defer to physicians and pathologists (Evans, 1968; Ferraro et al., 2016; Grant, 2007).

Data from the Delphi project were revisited as well, to consider all aspects of the responses from the two groups to determine if any new codes or practices could be identified. This step was important as it represents the iterative examination of all available data from both the MLS practitioners and the expert panel.

Results from MLS Practitioner Survey and Comparison to Expert Panel

The following represents the results from both the MLS practitioner survey and the comparison to the responses from the expert panel in both Rounds Two and Three, depending on when the practice reached consensus. Again, a level of agreement at 75% was considered consensus for the practitioners to maintain consistency in the

interpretation of the data. In addition, for certain items the mean deviation score was calculated to compare the expert responses with the practitioner responses and determine the differences in the levels of agreement for each of the identified disciplinary literacy practices.

Identified Disciplinary Literacy Practices

The MLS practitioners were asked to evaluate their level of agreement with the disciplinary literacy practices that had been identified and reached consensus among the expert panel. Each table shows a comparison of the level of agreement in a 3 point scale between the expert panel and the practitioners and also includes the mean deviation score. Each group of practices, representing reading, writing, and oral communication, will be represented in individual tables. See Tables 13, 14, and 15 for results.

Reading Practices of MLS. The following reading practices reached consensus among both the expert panel and the MLS practitioners. See Table 13 for the results of the statistical analyses.

Table 13

MLS Practitioner Data Analysis. Reading Practices of MLS – Level of Agreement (Expert Panel and MLS Practitioners) and Mean Deviation Score

Reading Practices in MLS Relate to Keeping Informed					
Reading in MLS is done to answer a question or solve a problem					
	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	4.2%		95.8%		24
MLS Practitioners	0.9%	1.8%	97.3%		224
	N	Mean	Deviation Score (Experts – Practitioners)		
Experts	24	4.54			
MLS Practitioners	224	4.77	-0.226		

Reading in MLS is done to stay up to date on current issues in medicine, testing, and procedures					
	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	4.2%		95.8%		24
MLS Practitioners	1.8%	0.9%	97.3%		224
	N	Mean	Deviation Score (Experts – Practitioners)		
Experts	24	4.67			
MLS Practitioners	224	4.74	-0.074		

Reading in MLS is done to learn about and review new technologies, products, or instruments					
	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	8.3%	4.2%	87.5%		24
MLS Practitioners	0.9%	2.7%	96.4%		224
	N	Mean	Deviation Score (Experts – Practitioners)		
Experts	24	4.50			
MLS Practitioners	224	4.74	-0.237		

Reading is done to prepare or remain knowledgeable in order to teach students and/or coworkers and others in healthcare.					
	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	4.2%		95.8%		24
MLS Practitioners	1.3%	4.5%	94.2%		224
	N	Mean	Deviation Score (Experts – Practitioners)		
Experts	24	4.54			
MLS Practitioners	224	4.68	-0.137		

Reading Practices in MLS Relate to Evaluation and Action

Reading patient results requires interpretation and analysis of the results.					
	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	4.2%		95.8%		24
MLS Practitioners		0.9%	99.1%		224
	N	Mean	Deviation Score (Experts – Practitioners)		
Experts	24	4.75			
MLS Practitioners	224	4.91	-0.161		

Using instruments, kits, or other reagents requires reading an instrument manual or product insert.					
	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	8.3%		91.7%		24
MLS Practitioners	0.4%	1.3%	98.2%		224
	N	Mean	Deviation Score (Experts – Practitioners)		
Experts	24	4.58			
MLS Practitioners	224	4.90	-0.318		

Reading standard operating procedures (SOPs) provides detailed information for performing tests and communicating results to clinical staff.

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	4.2%		95.8%		24
MLS Practitioners	1.3%	1.8%	96.9%		224
	N	Mean	Deviation Score (Experts – Practitioners)		
Experts	24	4.79			
MLS Practitioners	224	4.87	-0.079		

Quality control and calibration results must be read and evaluated prior to patient testing to confirm the test system is working appropriately and providing accurate results for patients.

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	4.2%	8.3%	83.3%	(4.2%)	23
MLS Practitioners		0.9%	99.1%		224
	N	Mean	Deviation Score (Experts – Practitioners)		
Experts	23	4.65			
MLS Practitioners	224	4.95	-0.294		

Reading is done to troubleshoot the problem when pre-analytical errors occur, when patient results are not consistent, or when instruments present errors.

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	8.3%		91.7%		24
MLS Practitioners		2.7%	96.9%	0.4%	224
	N	Mean	Deviation Score (Experts – Practitioners)		
Experts	24	4.42			
MLS Practitioners	223	4.80	-0.386		

Reading practices in MLS include systems that do not require written words (semiotic systems)

Reading in MLS involves understanding auditory cues.

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	4.2%	8.3%	87.5%		24
MLS Practitioners	2.7%	6.7%	90.2%	0.4%	224
	N	Mean	Deviation Score (Experts – Practitioners)		
Experts	24	4.54			
MLS Practitioners	223	4.61	-0.068		

Reading in MLS involves interpretation of numbers and numerical values in a wide variety of contexts.

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts			100%		24
MLS Practitioners		1.8%	98.2%		224

	N	Mean	Deviation Score (Experts – Practitioners)
Experts	24	4.92	
MLS Practitioners	224	4.88	0.042

Reading in MLS involves visual analysis, which may include graphical representations

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	4.2%		95.8%		24
MLS Practitioners		0.9%	99.1%		224

	N	Mean	Deviation Score (Experts – Practitioners)
Experts	24	4.79	
MLS Practitioners	224	4.84	-0.048

Reading in MLS involves visual analysis, which may include images

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	4.2%		95.8%		24
MLS Practitioners		0.9%	99.1%		224

	N	Mean	Deviation Score (Experts – Practitioners)
Experts	24	4.83	
MLS Practitioners	224	4.88	-0.051

Reading in MLS involves visual analysis, which may include reading patient results that require interpretation of color changes, agglutination, colony formation and growth patterns on agar, cell morphology, stain results, etc.

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	4.2%		95.8%		24
MLS Practitioners		0.9%	99.1%		224

	N	Mean	Deviation Score (Experts – Practitioners)
Experts	24	4.75	
MLS Practitioners	224	4.93	-0.179

Visual analysis also includes interpretation of whether the results are correct or incorrect.

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts			100%		24
MLS Practitioners	0.4%		98.7%	0.9%	224

	N	Mean	Deviation Score (Experts – Practitioners)
Experts	24	4.92	
MLS Practitioners	222	4.93	-0.016

**Experts identified in MLS Practitioner Survey Removed*

Quantitative Analyses. All of the identified practices reached consensus among the MLS practitioners who responded to the survey and all practices reached 90%

agreement or higher. Twelve of the fifteen identified practices demonstrated an absolute deviation score of < 0.25 , suggesting that both the expert panel and the MLS practitioners agreed consistently and at the same level (Somewhat or Strongly) for those practices. In most cases for these practices, the MLS practitioners had a level of agreement that was higher than that of the expert panel, thus the deviation score had a negative value. The one exception had a deviation value of < 0.05 , so the difference was very minor.

Three of the fifteen practices showed absolute deviation scores that were slightly higher between the expert panel and the MLS practitioners. For example the practice *Quality control and calibration results must be read and evaluated prior to patient testing to confirm the test system is working appropriately and providing accurate results for patients* had an 83% agreement level among the experts as compared to a 99% agreement percentage among the MLS practitioners. This difference was also confirmed in the mean deviation score, which was -0.294 . It should be noted, however, that a value of -0.294 is still relatively small, and both means for each group still show a high level of agreement among the two groups.

There were two practices that had an absolute deviation score of > 0.3 . These included the practices *Using instruments, kits, or other reagents requires reading an instrument manual or product insert* and *Reading is done to troubleshoot the problem when pre-analytical errors occur, when patient results are not consistent, or when instruments present errors*. In both cases the differences had to do with the level of agreement between the experts and the practitioners. The experts tended to respond Somewhat agree more often than Strongly agree, while the practitioners responded more

Strongly agree to the practice. The combined agreement percentages were similar, but the means were more divergent because of the response using the 5 point Likert scale.

Qualitative Analyses. The comments from the practitioners revealed some interesting thoughts and concerns, along with additions to the practices. Under the reading practices related to keeping informed in MLS, one participant suggested that reviewing new textbooks should be included among the practices. This concept would fit under the practice of *Reading is done to prepare or remain knowledgeable in order to teach students and/or coworkers and others in healthcare.* In addition, staying up to date also includes mandatory or compliance training, and this concept would fit under the practice of *Reading in MLS is done to stay up to date on current issues in medicine, testing, and procedures.*

Primary concerns identified by the MLS practitioners were a lack of time and little support for these practices. These concerns were demonstrated separately by two respondents, where one indicated; “I don't think adequate time is given to bench technologist[s] to read as part of the job” while the other stated “access to professional journals and literature needs to be embraced by employers better.” These participants suggest that, while reading to keep informed is important, it is not supported adequately.

Another participant suggested that reading to stay informed may be more important depending on the role that an MLS professional has in the workplace; “I suspect there is a wide variety of answers here, based on how much responsibility you have in your job.” Other respondents suggested that interest has a big effect on whether this type of reading is performed. One practitioner indicated “this type of reading, in my

experience, is performed by techs who want to learn more. To increase their own personal knowledge” while another suggested:

While I read to stay up to date on current issues, I find that my co-workers do not. I believe this is in part because I find this to be a career and am active in ASCLS. My co-workers 'do their job'.

This perceived difference may be due to the previously mentioned concerns of lack of time and support, or a genuine lack of interest.

Comments related to reading practices for evaluation and action in MLS identified some additions to the practices as well, and also some observations about these practices. One practitioner listed some additions to the identified practices: “Preparing for accreditation inspections. To prepare for Root Cause Analysis sessions. To answer physician questions.” These are all important aspects of the profession, but could be reorganized into other, already identified areas. For instance, reading in order to answer physician questions could relate to the practice *Reading is done to prepare or remain knowledgeable in order to teach students and/or coworkers and others in healthcare*, while preparing for a Root Cause Analysis would likely fall under the practice *Reading is done to troubleshoot the problem*, as this method looks at a problem from a higher level to understand how the problem happened. Preparing for accreditation inspections plays a role in several of these practices, as reviewing all documents in the laboratory – from the SOPs to the quality control records to instrument manuals and personnel records – are all part of the inspection process and have to be reviewed periodically.

Other practitioners commented that just reading may not be enough to really know a particular task, and instead suggested that performance is important. One respondent indicated that “reading SOP'S rarely makes them stick. Repeated

performance will make them stick,” while another posited that “all areas should definitely be taught where understanding is shown before application at the bench.” In these cases, the respondents felt that practice and repetition were key in really knowing a procedure, rather than just reading. However, repeated performance and understanding in the context of reading for evaluation and action makes sense. The MLS professional must be able to read and interpret a particular text, such as an SOP or patient result, but then they must be able to follow up with an action, such as performing a test or reporting out the result. The knowledge required for evaluation and the associated action takes time and practice to learn and become proficient.

Another MLS professional felt that these practices related more to critical thinking and they argued; “some of these strike me as being more about critical thinking than about reading. I realize you have noted "evaluation and action", but again [I’m] not sure [I] would have characterized these as reading.” Reading is the first step in order to make a decision about a particular situation or problem, and also relates back to reading to keep informed, so that a solution may become apparent. One MLS practitioner lamented that these types of practices are not demonstrated or supported for new professionals: “Practices not mentored enough by veteran techs. Young techs are not sticking with the problem until resolved. Supervisors are not encouraging to them in order to build on their knowledge at the bench.” This respondent felt there was a lack of guidance for young professionals to apprentice them into these practices.

A new reading practice was initially identified by one MLS expert at the conclusion of Round Three, and was also acknowledged by two MLS practitioners when they considered the semiotic systems associated with MLS. That new practice related to

visual analysis and included visual cues for hearing impaired employees. The two MLS practitioners noted this new practice by stating; “there may also be visual cues that can replace auditory cues for those that have hearing difficulties” and “we have ways to substitute auditory cues for employees who are hearing impaired.” These signals help professionals who are unable to hear an auditory cue, so that they are able to perform their jobs appropriately.

Two respondents commented on the practice *Reading in MLS involves visual analysis, which may include reading patient results that require interpretation of color changes, agglutination, colony formation and growth patterns on agar, cell morphology, stain results, etc.* One suggested that, though there is advancement in technology, this type of testing will remain important; “manual testing is a cornerstone of MLS and will be for the foreseeable future.” Another practitioner commented, “this is why our profession is so difficult, there are many disciplines required for result [interpretation],” acknowledging that there are several departments within a laboratory and each requires a particular set of skills to interpret the various types of testing done in each area.

Writing Practices of MLS. The following writing practices reached consensus among the expert panel and were presented to the MLS practitioners for evaluation. See Table 14 for the results of the statistical analyses.

Table 14

MLS Practitioner Data Analysis. Writing Practices of MLS – Level of Agreement (Expert Panel and MLS Practitioners) and Mean Deviation Score

Writing practices in MLS directed at an audience inside the clinical workplace have particular purposes:					
Writing in MLS is done to maintain a continuity of services.					
	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	8.3%	8.3%	83.3%		24
MLS Practitioners	4.0%	6.7%	88.4%	(0.9%)	222
	N	Mean	Deviation Score (Experts – Practitioners)		
Experts	24	4.25			
MLS Practitioners	222	4.46	-0.205		
Writing in MLS is done to document a wide variety of things.					
	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	4.2%		95.8%		24
MLS Practitioners	0.4%	1.8%	97.3%	(0.4%)	223
	N	Mean	Deviation Score (Experts – Practitioners)		
Experts	24	4.88			
MLS Practitioners	223	4.83	0.041		
Writing in MLS is done to record patient results.					
	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	12.5%	4.2%	83.33%		24
MLS Practitioners	5.8%	2.7%	90.6%	(0.9%)	222
	N	Mean	Deviation Score (Experts – Practitioners)		
Experts	24	4.38			
MLS Practitioners	222	4.54	-0.166		
Writing of standard operating procedures (SOPs) is done to provide a step-by-step process for running an instrument or test method.					
	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts			100%		24
MLS Practitioners	1.3%	0.9%	96.9%	(0.9%)	222
	N	Mean	Deviation Score (Experts – Practitioners)		
Experts	24	5.00			
MLS Practitioners	222	4.86	0.140		

Writing policies outlines the overall guidelines for the daily processes of the laboratory.

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts		4.2%	95.8%		24
MLS Practitioners	1.8%	0.4%	96.4%	(1.3%)	221
	N	Mean	Deviation Score (Experts – Practitioners)		
Experts	24	4.92			
MLS Practitioners	221	4.78	0.138		

Writing orders enables the lab to purchase necessary supplies and equipment.

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts		16.7%	83.3%		24
MLS Practitioners	4.0%	10.7%	84.8%	(0.4%)	223
	N	Mean	Deviation Score (Experts – Practitioners)		
Experts	24	4.25			
MLS Practitioners	223	4.33	-0.077		

Writing in MLS is done to communicate with and between personnel.

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts			100%		24
MLS Practitioners		2.2%	97.3%	(0.4%)	223
	N	Mean	Deviation Score (Experts – Practitioners)		
Experts	24	4.83			
MLS Practitioners	223	4.78	0.053		

Writing practices in MLS that are directed to an audience outside the clinical workplace also have particular purposes**In MLS, professional writing is done for other professionals outside of the clinical setting.**

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	20.8%		79.2%		24
MLS Practitioners	8.5%	13.8%	77.7%		224
	N	Mean	Deviation Score (Experts – Practitioners)		
Experts	24	3.75			
MLS Practitioners	224	4.11	-0.362		

In MLS, writing for accreditation or regulatory bodies is done to meet the requirements to maintain accreditation and regulation.

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	4.2%		95.8%		24
MLS Practitioners	1.8%	6.7%	91.5%		224
	N	Mean	Deviation Score (Experts – Practitioners)		
Experts	24	4.46			
MLS Practitioners	224	4.54	-0.086		

In MLS, writing is done by MLS professionals and educators to convey information to students.

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	4.2%		95.8%		24
MLS Practitioners	2.7%	4.5%	92.9%		224
	N	Mean	Deviation Score (Experts – Practitioners)		
Experts	24	4.54			
MLS Practitioners	224	4.56	-0.016		

In MLS, writing is done by MLS professionals and educators to convey information to the general public.

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	15.8%	5.3%	78.9%	(20.8%)	19†
MLS Practitioners	23.2%	14.7%	62.1%		224
	N	Mean	Deviation Score (Experts – Practitioners)		
Experts	19†	3.89			
MLS Practitioners	224	3.61	0.288		

Writing or production practices in MLS relate to systems that do not use written words (semiotic systems)**Writing in MLS involves numbers associated with patient values, budgets, etc.**

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts			100%		24
MLS Practitioners	0.9%	3.6%	95.1%	(0.4%)	223
	N	Mean	Deviation Score (Experts – Practitioners)		
Experts	24	4.92			
MLS Practitioners	223	4.70	0.217		

Writing in MLS involves visual representations, such as the production of diagrams, flow charts, graphs, etc. to convey information.

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	4.2%	8.3%	87.5%		24
MLS Practitioners	3.1%	6.3%	90.6%		224
	N	Mean	Deviation Score (Experts – Practitioners)		
Experts	24	4.58			
MLS Practitioners	224	4.46	0.124		

Writing in MLS involves visual representations, such as the production of images, including still pictures, animations, videos, etc.

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	8.3%		91.7%		24
MLS Practitioners	8.9%	12.5%	78.6%		224

	N	Mean	Deviation Score (Experts – Practitioners)
Experts	24	4.38	
MLS Practitioners	224	4.13	0.250

*Experts identified in MLS Practitioner Survey Removed

†Expert responses from Round Three survey represented

Quantitative Analyses. All but one of the identified practices reached consensus among the MLS practitioners. Several practices demonstrated a > 90% agreement level, but there were some that were > 80% and one that was close to the 75% minimum for consensus. Eleven of the fourteen practices demonstrated an absolute deviation score of < 0.25, suggesting that both the expert panel and the MLS practitioners agreed consistently and at the same level (Somewhat or Strongly) for those practices. The expert panel exhibited a higher level of agreement compared to the MLS practitioners more than half the time for these practices, which was indicated by the positive deviation score. These findings are interesting, given the much stronger level of agreement between the two groups regarding the reading practices in MLS. There is more variability in agreement levels related to the writing practices of the profession, and could be a demonstration of what Carter (2007) refers to when he stated; “In a model of education understood as the delivery of specialized disciplinary literacy knowledge, writing is considered outside the disciplines” (p.386). Learning to write in the MLS profession may be so tacit, that laboratory professionals do not consider how they learned to write in the profession, nor do they reflect on the essential writing tasks that are specific to the profession.

Three of the identified practices had a deviation score between 0.25 and 0.37. The practice *In MLS, professional writing is done for other professionals outside of the clinical setting* had a deviation score of -0.362, but agreement levels for both groups of

greater than 75% but less than 80%. Half of the experts only Somewhat agreed while a little over a third of the MLS practitioners answered this way. In general, although this practice reached consensus among both groups, agreement was not particularly strong in either group. The deviation came from the level of agreement responses between the two groups, which leaned more to stronger agreement for the MLS practitioners.

The practice *Writing in MLS involves visual representations, such as the production of images, including still pictures, animations, videos, etc.* had a deviation score of 0.25 but the levels of agreement were quite different between the groups. While there was over 90% agreement by the experts, there was less than 80% agreement among the MLS practitioners. This difference was reflected in the numbers of participants who responded Strongly agree, as both groups had similar values associated with Somewhat agree.

The one practice that did not reach consensus among the MLS practitioners was *In MLS, writing is done by MLS professionals and educators to convey information to the general public.* This practice reached consensus with the expert panel during the Round Three survey. Although there were only 19 respondents, there was approximately 79% agreement with this practice among the expert panel. In contrast, only 62% of the MLS practitioners agreed with this statement. The deviation score for this question was also higher, at 0.288, which reflected the higher level of agreement by the expert panel, and demonstrated the differences in levels of agreement (Somewhat as compared to Strongly agree) between the expert panel and the MLS practitioners. The overall agreement was lower for the MLS practitioners, but the experts demonstrated a higher level of only Somewhat agreeing with the statement.

Qualitative Analyses. The comments from the practitioners revealed some interesting observations about the types of writing practices that occur in the laboratory. When it came to the writing practices directed at an audience inside the clinical workplace, several of the MLS practitioners indicated that much of this writing happens electronically or through the LIS software; one participant stated “mostly in electronic format,” while another said “writing is often dictated by LIS software,” and a different participant indicated “many items above are electronic with available templates or approved comments to be selected.” This concept was first identified among the expert panel in their responses to the Round Two survey. However, when this idea was presented to the expert panel again during the Round Three survey, it did not reach consensus and only 42% of the experts agreed with the statement. Comments from the expert panel revealed that, while it is true that the LIS is programmed with established comments to maintain consistency and perform the appropriate calculations when necessary, a laboratory professional must set up the comments and program the calculations, and MLS professionals must also be able to review the results and determine if the LIS is working as designed or if there is an error in the program. For those professionals that are not part of the set up for these systems, the sensation is likely one of little choice in what is written, which would explain why these practitioners commented in this way.

Another MLS practitioner’s comment reflected a multimodal practice when they suggested “oral communication better for ‘hand-offs’ between shifts.” This same sentiment was expressed by members of the expert panel and demonstrates the multimodality and interconnectedness of these disciplinary literacy practices. A different

perspective was expressed by another MLS practitioner, who lamented that “communication is the cause of most problems in the laboratory.” Without further explanation for this comment, it is difficult to determine the kind of problems to which this individual is referring. It is not known whether they mean a lack of communication causes problems or too much or incorrect communication is an issue. This would have been an interesting line of inquiry to pursue.

For those writing practices that are directed to an audience outside the clinical workplace, some interesting observations were presented. Several MLS practitioners suggested that the type of writing done by MLS professionals is quite particular and would only really be understood by a limited group of people. One respondent indicated that MLS “writing styles not outside user friendly,” while another professional considered that “the level of audience understanding is an important piece in writing practices.” This statement was supported by a different MLS practitioner who suggested “if ‘other’... are non-lab professionals, then oral communication is better to supplement written communication.” In this case the respondent implies that how MLS professionals communicate is different from other areas in healthcare and this may also apply to individuals outside of healthcare altogether. The participant felt that oral communication would be a better way to address those outside of the profession.

Several MLS practitioners observed that writing for the general public is not very common in the profession, which was reflected in the low level of agreement for that particular practice. One respondent stated that “not enough writing is done to convey info to the general public,” while another supported this concept by indicating “very few MLS professionals write information for the general public.” In contrast, an MLS

practitioner suggested that writing “for the general public seems to be just getting started.” Perhaps this is an indication that these perspectives may be changing in the future.

Other MLS practitioners suggested that writing in MLS should not only educate the public, but also others in healthcare as well. One respondent proposed the idea that “MLS writing does well to communicate thoughts and ideas to other MLS but lacks presence with public and other health professionals,” and another participant advocated that “we should also write to educate [providers] within our facilities and improve lab usage.” These practitioners suggest that MLS professionals should use their knowledge of the various tests in the laboratory, along with the changing technology, to provide useful suggestions and accurate information to physicians for better patient testing.

Another concern that was presented in the comments had to do with a lack of support or opportunity to perform these types of writing tasks. One respondent lamented:

There is not nearly enough support from employers for continuing education and professional presentations. In Nursing and Laboratories many are required to do CEs but have little to no support [from] their employers, leading to loss of certifications and stagnation in the field.

Two other participants wished for more opportunities to write in this manner, stating “we do not do enough of this type of writing,” and “I wish we had more opportunities to participate in these kinds of writing projects, but they almost never happen.” These MLS practitioners would like to participate in these types of writing endeavors, but are unable to do so because they have no occasion to write in this manner. One MLS educator highlights a major difference in this area, between the clinical laboratory setting and academia, by stating “I do A LOT more writing in my position as an MLT Educator than I ever did when I worked ‘on the bench’ in the lab.” This seems to be consistent with the

experiences of the other participants, suggesting that writing may be more common for educators when compared to a bench level laboratory professional.

The topic that received the most comments associated with writing or production practices related to semiotic systems involving images. In one case, the respondent commented that “our instruments generate images. Not sure if MLS typically communicate with images.” However, other participants supported the importance of using images in communication. One MLS practitioner posited that “images are critical- as humans we are bombarded with images and visual presentation is expected,” while another considered that “these new options are very powerful and can make a visual statement that is not readily conveyed by just looking at numbers,” and still another respondent supported the use of images by stating “visual representation are always a plus in supplementing oral communication.” These statements show that images are helpful in conveying and understanding information presented to an individual.

One comment in particular could be related back to some of the comments in the previous group of writing practices, and suggested that “presentations (visual) usually are only done for students.” So while the previous comments suggested that opportunities for writing, particularly to the general public and providers, was limited, so too are presentations restricted to just students. In contrast, some members of the expert panel specifically identified the practice of teaching and presenting to other members of the healthcare team, such as nurses or medical residents, and PowerPoint development could certainly be part of that process. It seems experiences in this area are varied, depending on the institution and individual.

Oral Communication Practices of MLS. The majority of the following oral communication practices reached consensus among the expert panel and were subsequently presented to the MLS practitioners for evaluation. The practice relating to oral communication between MLS professionals and patients was included in the MLS practitioner survey, even though it did not reach consensus among the expert panel, to see if any MLS professionals perform this particular practice. See Table 15 for the results of the statistical analyses.

Table 15

MLS Practitioner Data Analysis. Oral Communication Practices of MLS – Level of Agreement (Expert Panel and MLS Practitioners) and Mean Deviation Score

Oral communication practices occur between coworkers in the laboratory					
Oral communication practices in MLS is done to maintain a continuity of service so that patient care continues seamlessly between shifts.					
	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts			100%		24
MLS Practitioners	1.8%	0.9%	96.9%	(0.4%)	223
	N	Mean	Deviation Score (Experts – Practitioners)		
Experts	24	4.92			
MLS Practitioners	223	4.77	0.150		
Oral communication practices in MLS are done to communicate information about instruments and reagents, including instrument or reagent status, quality control, calibration, etc.					
	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	8.3%		100%		24
MLS Practitioners		1.3%	98.2%	(0.4%)	223
	N	Mean	Deviation Score (Experts – Practitioners)		
Experts	24	4.96			
MLS Practitioners	223	4.84	0.120		
Oral communication practices in MLS are for problem solving					
	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts			100%		24
MLS Practitioners	0.9%	1.8%	97.3%		224

	N	Mean	Deviation Score (Experts – Practitioners)
Experts	24	4.92	
MLS Practitioners	224	4.83	0.086

Oral communication practices in MLS are done for training.

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts			100%		24
MLS Practitioners	0.4%	1.3%	98.2%		224

	N	Mean	Deviation Score (Experts – Practitioners)
Experts	24	4.92	
MLS Practitioners	224	4.85	0.068

Oral communication practices in MLS are done between bench level MLS and supervisors / managers.

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	4.2%	4.2%	91.7%		24
MLS Practitioners	3.6%	4.9%	91.5%		224

	N	Mean	Deviation Score (Experts – Practitioners)
Experts	24	4.71	
MLS Practitioners	224	4.58	0.132

Oral communication practices occur between the laboratory staff and clinical staff

Oral communication practices in MLS are done to convey information.

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts			100%		24
MLS Practitioners	1.3%	1.3%	97.3%		224

	N	Mean	Deviation Score (Experts – Practitioners)
Experts	24	4.92	
MLS Practitioners	224	4.82	0.095

Oral communication practices in MLS are done to ask or answer questions.

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	4.2%	4.2%	91.7%		24
MLS Practitioners	1.8%	3.6%	94.2%	(0.4%)	223

	N	Mean	Deviation Score (Experts – Practitioners)
Experts	24	4.75	
MLS Practitioners	223	4.71	0.037

Oral communication practices occur between the laboratory staff and others associated with healthcare

Oral communication practices in MLS are associated with instrument maintenance.

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts		8.3%	91.7%		24
MLS Practitioners	1.8%	3.6%	93.8%	(0.9%)	222

	N	Mean	Deviation Score (Experts – Practitioners)
Experts	24	4.71	0.109
MLS Practitioners	222	4.60	

Oral communication practices in MLS are associated with other service providers such as couriers or other delivery personnel.

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	8.3%	16.7%	75.0%		24
MLS Practitioners	3.6%	5.8%	90.2%	(0.4%)	223

	N	Mean	Deviation Score (Experts – Practitioners)
Experts	24	4.13	-0.332
MLS Practitioners	223	4.46	

Oral communication practices in MLS are associated with reference and state laboratories.

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	10.5%		89.5%	(20.8%)	19†
MLS Practitioners	8.0%	10.7%	80.4%	(0.9%)	222

	N	Mean	Deviation Score (Experts – Practitioners)
Experts	19†	4.32	0.023
MLS Practitioners	222	4.29	

Oral communication practices occur between the laboratory staff and others outside of healthcare

Oral communication practices in MLS may be associated with patients. *Though this is not something that most MLS professionals do consistently, with the advent of online health portals it would be beneficial for patients to have access to laboratory professionals to understand their test results.*

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	21.1%	10.5%	68.4%	(20.8%)	19†
MLS Practitioners	24.1%	11.2%	63.8%	(0.9%)	222

	N	Mean	Deviation Score (Experts – Practitioners)
Experts	19†	4.00	0.347
MLS Practitioners	222	3.65	

Oral communication practices in MLS can be associated with legislators, community members, donors, etc. *Though this is not something that most MLS professionals do consistently, they can be associated with MLS professionals who are members of professional societies that work on advocacy issues.*

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	5.3%	10.5%	84.2%	(20.8%)	19†
MLS Practitioners	12.9%	16.1%	71.0%		224

	N	Mean	Deviation Score (Experts – Practitioners)
Experts	19†	4.37	0.458
MLS Practitioners	224	3.91	

Oral communication practices in MLS can be associated with legislators, community members, donors, etc. *In an ideal world, it would be beneficial for MLS professionals to become involved in legislative issues and/or to make the profession known to the larger community.*

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	5.3%	5.3%	89.5%	(20.8%)	19†
MLS Practitioners	8.9%	15.6%	74.6%	(0.9%)	222
	N	Mean	Deviation Score (Experts – Practitioners)		
Experts	19†	4.42			
MLS Practitioners	222	4.09	0.336		

Oral communication practices can be associated with education

Oral communication practices in MLS are related to continuing education.

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts		4.2%	95.8%		24
MLS Practitioners	4.5%	8.5%	86.2%	(0.9%)	222
	N	Mean	Deviation Score (Experts – Practitioners)		
Experts	24	4.54			
MLS Practitioners	222	4.41	0.127		

Oral communication practices in MLS are related to presentations for others in healthcare, who are not MLS professionals.

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	12.5%	8.33%	79.17%		24
MLS Practitioners	16.1%	13.4%	70.5%		224
	N	Mean	Deviation Score (Experts – Practitioners)		
Experts	24	3.96			
MLS Practitioners	224	3.97	-0.011		

Oral communication practices in MLS are related to teaching students.

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts			100%		24
MLS Practitioners	0.4%	2.7%	96.9%		224
	N	Mean	Deviation Score (Experts – Practitioners)		
Experts	24	4.88			
MLS Practitioners	224	4.75	0.125		

Continuing education and teaching students can also be presented online (often using both a written format and a recorded presentation) and are not strictly done using oral communication practices.

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	15.8%		78.9%	(25.0%)	18†
MLS Practitioners	3.1%	3.1%	93.3%	(0.4%)	223

	N	Mean	Deviation Score (Experts – Practitioners)
Experts	18†	4.33	-0.250
MLS Practitioners	223	4.58	

*Experts identified in MLS Practitioner Survey Removed

†Expert responses from Round Three survey represented

Quantitative Analyses. There was a high level of agreement and consensus for thirteen of the seventeen identified practices. In many cases, the practices reached > 90% agreement for both the experts and practitioners. The exception were those practices related to the oral communication practices that occur between the laboratory staff and others outside of healthcare. In three instances, consensus had been reached among the expert panel, but the practice did not reach consensus among the MLS practitioners. In five cases, the level of agreement was quite different between the experts and practitioners. All but four of the practices had an absolute mean deviation score of < 0.25, suggesting that both the expert panel and the MLS practitioners agreed consistently and at the same level (Somewhat or Strongly) for those practices. For the majority of these practices, the expert panel demonstrated a higher level of agreement compared to the MLS practitioners, which was indicated by the positive deviation score.

All three items that were associated with the oral communication practices that occur between the laboratory staff and others outside of healthcare had mean deviation scores > 0.3 but < 0.5. The experts had a much higher level of agreement with the statement as compared to the MLS practitioners. These practices included those that involved clarifying statements (underlined):

*Oral communication practices in MLS may be associated with patients.
Though this is not something that most MLS professionals do consistently,
with the advent of online health portals it would be beneficial for patients
to have access to laboratory professionals to understand their test results.*

Oral communication practices in MLS can be associated with legislators, community members, donors, etc. Though this is not something that most MLS professionals do consistently, they can be associated with MLS professionals who are members of professional societies that work on advocacy issues.

Oral communication practices in MLS can be associated with legislators, community members, donors, etc. In an ideal world, it would be beneficial for MLS professionals to become involved in legislative issues and/or to make the profession known to the larger community.

None of these practices reached consensus among the MLS practitioners, though the last practice did come close at 74.6% agreement. The practices associated with legislators and community members had agreement levels among the expert panel between 84-90%. Neither group reached consensus for the practice associated with communication with the patient. Both groups had agreement levels below 70%. These discrepancies in the levels of agreement affected the mean deviation. In the case of the practice associated with communication with patients, a larger percent of the experts Strongly agreed with the statement, compared to the MLS practitioners.

The practice *Oral communication practices in MLS are associated with other service providers* had a deviation score of -0.332, suggesting that the MLS practitioners agreed more strongly with this statement compared to the expert panel. While the experts just reached consensus at 75% agreement, practitioners had a much higher level of agreement at 90%. The deviation score was affected because of the varying levels of the strength of agreement between the groups. While only 50% of the experts strongly agreed with the statement, nearly 60% of the practitioners agreed. The level of Somewhat agree was also higher for the MLS practitioners.

The other practice that had a mean deviation score at -0.250 was *Continuing education and teaching students can also be presented online (often using both a written*

format and a recorded presentation) and are not strictly done using oral communication practices. Again, the overall level of agreement was slightly different as not quite 80% of the experts agreed with the statement, while 93% of the MLS practitioners agreed. Although there was a similar percent of respondents that Strongly agreed, there was a much greater percent of practitioners that Somewhat agreed with the statement as compared to the experts. This is consistent with the negative mean deviation score.

Qualitative Analyses. The comments from the practitioners revealed some additions to several of the identified practices as well as enlightening observations about the types of oral communication practices that occur both within the laboratory setting and outside of it. When it came to the oral communication practices that occur between coworkers in the laboratory, one MLS practitioner pointed out that this type of communication also happens "...between disciplines and between [different] lab sites within a system." This addition would fit well in the identified practice *Oral communication practices in MLS is done to maintain a continuity of service so that patient care continues seamlessly between shifts.* In this case it could also refer to maintaining a continuity of services between locations and departments.

Many of the respondents presented one particular multimodal practice, specifically the use of a log or other type of written communication in addition to the oral communication for maintaining a continuity of service. One participant gave an example:

In my hospital, oral communication is used in addition to written communication. We have a change of shift log that a lead tech or supervisor goes to each bench and asks if there are [any] problems or communication the next shift needs to know.

This also applied to training new employees, who had a checklist to fill out while they were learning their job responsibilities. Another MLS practitioner indicated “hand written daily logs are also maintained that describe problems with samples, instruments, policies, etc. to create a chain of evidence for any follow through necessary,” while another respondent stated “we perform shift to shift huddles and go over info on a communication log.” One of the MLS practitioners explained a slightly different method for maintaining continuity of service in their institution:

We have discovered if left to only informal passing of information, often important issues are overlooked. We [have] instituted bi-weekly huddles where we are more formal and notes are taken, this [addition] to our oral communication has proved to be very valuable to assure important information is conveyed and posted for off shift folks to read.

This institution again incorporates written notes with the oral communication; however, in this case the oral communication takes precedence and the notes follow the flow of the conversation in the huddle.

In another case, a practitioner indicated that, rather than oral communication being used for communicating among coworkers, emails were more prominent; “Group emails seems to be the most of the preferred communication.” This concept was suggested by some members of the expert panel, so the primary method of communication may depend on the policies and procedures of a particular institution.

Training was also highlighted by the respondents. One MLS professional stated “laboratory professionals require extensive clinical training, which is predominantly oral.” However, another comment incorporated several literacies, such as reading SOPs and demonstrations, along with oral communication; “we train using procedures, and follow up with actual demo, observation and verbal for understanding.” So while most of

the training process may involve oral communication, there are other aspects – such as reading the SOPs and demonstrating competency – that are also important in the training process.

Several MLS practitioners suggested that the types of oral communication practices listed in this section were important, but often not consistently nor effectively performed. One respondent stated “these practices should be the norm, but often fall short,” while another indicated “this type of communication should happen but it doesn't always happen effectively,” and a different participant suggested “oral communication can always be improved. It seems to fall between the cracks a lot of time.” The attentiveness and interest of the person who is receiving the change-of-shift information was also presented as affecting this type of communication by one participant:

Communication ultimately depends on who you're talking to. Sometimes the person relieving you from your shift doesn't care to listen to what you're leaving them, while others ask all the necessary questions to find out what was going on in a way that they can seamlessly pick up where you left off without affecting TAT [turnaround times] and patient care.

This would likely qualify as an area that could use improvement with regard to oral communication among coworkers. In addition, MLS practitioners suggested that oral communication also falls short between the bench level MLS and their supervisors. One respondent observed that “I have more consistent communication with my peers than my Director, even though she is at times working a bench,” while another participant indicated that there is “not enough oral communication between bench level and supervisors.” In each of these cases, it does appear that there is room for improvement when it comes to oral communication practices of MLS professionals.

In relation to the oral communication practices that occur between the laboratory staff and clinical staff, two respondents identified some additional thoughts for these practices. One stated that “MLS also provide education to clinical staff,” and this was supported by another practitioner, who indicated that the communication served “to provide [advice] on correct tests, next tests to order. To explain results.” These enhance both practices in this category, where *Oral communication practices in MLS are done to convey information* and *Oral communication practices in MLS are done to ask or answer questions*. Educating clinical staff conveys information and providing advice or explaining results would be part of answering questions, as well as conveying information.

Several MLS practitioners indicated that these communication practices are not as strong as they should be. One respondent suggested that “... interactions amongst lab peers is very strong. Interaction with doctors, nurses, and other ancillary hospital ‘team members’ is lacking, unfortunately,” while another stated “MLS communication habits with other health professionals are poor and insufficient,” and still another contended that “communication between lab and clinical staff is often very weak and filled with confusion and a lack of understanding and empathy on both sides.” The lack of understanding was emphasized by another participant, who submitted that these types of communication practices “may require a strong personality... due to lack of understanding by other professions as to the lab’s role in needing additional info that relates to patient care.” Even though this type of communication is important for quality patient care, it appears that there are some difficulties in this area. One respondent suggested one way to manage these communication difficulties by stating that “all oral

communication should be followed up with written communication of the issue discussed to avoid any misunderstanding of the issue discussed.” The addition of following up the oral communication with writing serves to make sure all parties in the discussion understand what had been discussed and decided. This type of practice may not be appropriate in some situations, such as during an emergency, but would be useful when setting policies or explaining laboratory test options to physicians.

When presented with the oral communication practices that occur between the laboratory staff and others associated with healthcare, two of the MLS practitioners suggested some additions to the practices. One indicated that “in addition it occurs in a peer network with other similar institutions for comparison of methods/protocols, quality improvement, education and training, accreditation etc.” This may have a place in the *Oral communication practices in MLS are associated with reference and state laboratories*, where peer institutions could be added. Or this may represent a whole new practice to consider. Another participant stated “with instrument vendors,” and this would certainly be appropriate to add to the practice *Oral communication practices in MLS are associated with instrument maintenance* as manufacturer service representatives work for the instrument vendors.

Again, the multimodality of literacies became apparent in the comments for this practice as well. So not only is there oral communication, but also written communication that serves as a record of what was discussed. One MLS practitioner stated “oral communication with reference labs and state labs would be followed up with written communication,” and another supported this concept by indicating “we have found as often as we use oral communication once we deal with outside entities we prefer

it also be in written form so we have documentation.” This written record is helpful to return to, should any confusion arise.

In addition, some respondents suggested that these practices may not be performed using oral communication. Rather, there are online avenues for communication with outside entities. For example, one participant posited “many areas related to this topic are capable of being done online on the computer,” while another confirmed this idea by stating “I would say most of our reference lab communication is written or digital,” and still another supported these practitioners by agreeing, “most communication is done via email or online ordering.” These comments may support a new writing practice directed to an audience outside the clinical workplace. However, with a high level of agreement between both the expert panel and MLS practitioners for these practices, these comments demonstrate the multimodality of this area of MLS disciplinary literacy.

One area that received several comments that proved quite enlightening was the oral communication practices that occur between the laboratory staff and others outside of healthcare. These practices were explored in a deeper manner with the expert panel during the Round Three survey, so some controversy was anticipated. For all of these practices, a consensus was not attained among the MLS practitioners. The primary topic for many comments related to communication with patients, but communication with legislators, community members, and donors also did not reach consensus, and this area also received comments. One participant put it simply, stating “we do far [too] little outside communication,” but the lack of consensus and additional comments suggest this is a controversial topic.

Communication with legislators and community members had slightly more support than communication with patients. The practice that nearly reached consensus (74.6%) suggested that, in an ideal world, MLS professionals should be involved in communicating with legislators and/or the community, but only 71% agreed that these activities are associated with professional societies. One participant indicated “most communication with community and legislators is done through our state ASCLS association in conjunction with the national association,” but in contrast, another stated “we also have testified at the state level for licensure. We need to let our legislators know the importance of licensure for MLS professionals,” indicating a more proactive approach in communicating with legislators.

One MLS practitioner lamented “laboratory professionals tend to be somewhat introverted, so we are sorely lacking in public representation,” but another participant went a step further, suggesting “also... ‘ideal world’ with communication for legislative issue etc. seems to be a pipe dream. Nobody respects nor appreciates our input although we are the ones in direct knowledge of the laboratory, how it works, funds needed, etc.” These sentiments could be contrasted with two different MLS practitioners, who looked to the positive where one indicated “it would be amazing for our profession to be more visible,” and another valued the clarifying statements; “I appreciate the [qualifications] put on these statements looking for the ideal state!” Thus there seems to be a recognition of the challenges that MLS professionals face when it comes to representation, but also a desire to improve.

The oral communication practices that occur in relation to patients revealed several interesting points from the MLS practitioners. In particular, some respondents

posited that the communication most needed with patients was in relation to proper collection of samples. One participant suggested there is “not enough communication to patients on proper collection of urine and stool samples,” and this was supported by another practitioner, who indicated that “we get the better specimens submitted when we offer the explanation to the patient on how it must be collected.” This could likely be extended to not only these ‘at home’ types of sample collection, but also for explaining the importance of fasting for certain blood tests.

A topic that brought about several comments had to do with that of explanations to patients, so they could better understand their test results. Numerous MLS practitioners felt that this was not appropriate. For example, one respondent stated:

While it would be nice to be able to [communicate] directly to patients/community members, the data that we collect in the testing of various body fluids correlates to a disease. This data must then be interpreted as a whole to diagnose/treat a patient. The raw data by itself is not something that the patient/community/legislature/donor, is going to understand.

Another respondent suggested that interpretation is beyond the purview of MLS and they provided an example:

Communication with patients is currently limited by the scope of practice. While I am allowed to discuss what tests have been ordered (I do phlebotomy as part of my job), I am not allowed to tell them what these test results mean. It is “outside my scope of practice” and opens the facility to litigation.

Concerns about legal action were evident from other participants as well, with one suggesting “There is a risk involved with expecting MLS professionals to interpret results for a patient. This may be a task for a provider or DCLS [doctor of clinical laboratory science].” This practitioner felt that the physician or another medical professional with a higher level degree, such as the DCLS, would be more appropriate for result

interpretation. The apprehension around potential legal action should an MLS professional share their knowledge with patients was noteworthy, especially given that ASCLS specifically indicated in a position paper that MLS professionals are well within their scope of practice to be able to discuss interpretations and correlations of laboratory testing with consumers (e.g. patients) along with their physicians (ASCLS, 2012).

Other MLS practitioners deferred to the physicians, specifying that they have a more complete clinical picture compared to a laboratory professional. One respondent stated “discussion with patients about their specific test results should be handled by the health care professional who has access to the patient's TOTAL health picture,” and another agreed by indicating “although as an MLS, we can tell patients results, we should not be interpreting those results to the patient. We do not know where the patient is in their course of treatment or what is 'normal' for individual patients.” This general feeling was reflected by other respondents as well, and one felt that “I am still of the mindset that patients should be communicating with their providers for explanations of their test results and they correspond with their clinical conditions,” which was supported by another participant who suggested that “explaining lab results to patients should take place between a [Dr.] and a patient, not a MLS and a patient,” and another put it quite bluntly by stating “we are not allowed to give tests results or guidance to patients.” This same sentiment was echoed in another response, but for this particular professional, pay was an additional factor:

Other than giving a patient instructions on collection of samples, ex. Urines or Stool specimens, interpretation of test results to the patient is not part of an MLS job. It can cause issues for the tech, who may not know what information the patient has gotten from their physician. Interpretation of test results for a patient is not our job, we do not get paid enough for that responsibility.

In this case, pay scale was correlated to the level of responsibility that this practitioner felt they had in communicating with patients. While the collection of samples was considered part of their job responsibilities, interpretation of results was above the pay grade of the MLS professional. Another respondent deferred to pathologists, who are often the directors of the clinical laboratory, by suggesting that “it’s the Pathologists who have skin in the game, CLS is really a support role to the Pathologists,” which suggests that the laboratory professionals remain in the background when it comes to healthcare.

There were some contrasting statements by other the MLS practitioners, however. One respondent, who perhaps came from a more rural setting, revealed that some MLS professionals may have quite a bit of patient contact and communication. This individual stated “MLS in rural settings perform blood draws and have oral communication with patients very consistently.” Another practitioner felt that, rather than communicate with the patients, better communication avenues should be forged between laboratory professionals and physicians; “I believe there is a need for an increase in the communication that occurs between and MLS and the doctor to better understand lab results.” This concept would be a better fit under the oral communication practices that occur between laboratory staff and clinical staff, but offers an alternate way to help with patient care, though not directly with the patient. One MLS practitioner expressed the importance of making these connections and stated “it is extremely import for members of our profession to become involved and make connection to the above mentioned. We need to do it often enough to know what part of [our] profession makes a connection with them.” In this case, ‘them’ may refer to either patients, legislators, community members,

or donors, as presented in the question prompts, but the sentiment suggests that this is an oral communication practice that could be improved.

The final area of disciplinary literacy practices that was addressed involved the oral communication practices that are associated with education. In two cases, the MLS practitioners offered some adjustments to already established practices. One gave two areas that they felt should be added; “educating patients and the public in general. Educating students in middle and high school.” The education of patients and general public both would likely fall under some of the previously established practices. In particular, the education of patients fits under *Oral communication practices in MLS may be associated with patients*, even though this practice did not reach consensus. Educating the general public using oral communication may represent a crossover, or multimodal practice connected to the writing practice, *In MLS, writing is done by MLS professionals and educators to convey information to the general public*. This shows the possibilities for more interaction and communication with the public.

The idea of exposing younger students to the profession was discussed in a policy paper from ASCLS (2018) discussing the workforce shortage in MLS. Presenting the profession to younger students may be a way to enhance recruitment as well as increasing awareness of the profession to the general public. This concept could be incorporated into the practice *Oral communication practices in MLS are related to teaching students*. While many may have considered ‘students’ in this case to be laboratory pre-professionals, they could just as easily refer to middle and high school students.

Although the practice *Oral communication practices in MLS are related to presentations for others in healthcare, who are not MLS professionals* did reach

consensus among the expert panel, it did not reach consensus with the MLS practitioners. Two MLS practitioners suggested that educating other members of the healthcare team is important, as demonstrated by the following comment; “educating other healthcare professionals about what a clinical lab professional actually does, would benefit them and the patients that they provide care to.” Another respondent stated “It would be amazing to have laboratory techs provide education to nurses regarding the lab and vice versa,” but this individual had also observed that “unless you reach masters level or higher, I rarely have seen presentations by bench level techs.” There seems to be an area for improvement, but like the writing practices directed at outside audiences, it would likely require support from administrators, supervisors, and other members of the healthcare team.

There was also a focus on online learning; a multimodal practice involving a written presentation with a recording was presented for consideration. Although this reached consensus among both the expert panel and the MLS practitioners, some concerns were presented by the participants. In one case, the respondent focused on continuing education or training, stating “online training is generally aimed at lowest common denominator, making it insufferably simple for competent professionals.” Other participants considered the pre-professional students, and specifically indicated that direct, in-person learning is imperative. One practitioner emphatically indicated “online teaching should NOT take the place of ‘hands on learning’ in this profession. Should not allow certification without onsite training.” This sentiment was echoed by another respondent who indicated that “in my teaching experience, the students do not learn the material as well when it is only presented in an online format. Online learning should

supplement in-person verbal teaching, not replace it.” This was supported by another participant, who considered their own experience; “I think [I] benefited from oral communication to get the overview, written to gain a better understanding and hands on to put it all together.” This supports the multidisciplinary aspects of learning and how each area supports student education. A different MLS practitioner suggested “there is a reason students need clinical training, because book learning is not enough,” but this participant went on to differentiate student education with continuing education by stating “however with the proper background training/education, CE [continuing education] are appropriate online.” Having the background or foundational knowledge about the profession offers more opportunities for online education, where learning new information – as a student would – is more difficult in an online setting.

Effect of the Role of the MLS Professional in the Clinical Setting and Disciplinary Literacy Practices – Reading and Writing

The hierarchy of the lab is an important consideration; bench level MLS perform testing on a day to day basis, lead MLS professionals work the bench and complete other duties, department heads or supervisors oversee departments, and laboratory managers oversee all departments in the laboratory.

The comments provided by the expert panel members during both the Round Two and Three survey often suggested that certain disciplinary literacy practices were performed by particular MLS professionals, depending on the type of job they held in the institution. Initially, during the Round Two survey of the Delphi project, the expert panel was presented with two sets of statements under both reading and writing practices, suggesting that bench level professionals read and write in a limited way, while

supervisors or managers read and write in a broader way (Camillo, 2018). In the Round Two survey, both of these sets of questions reached consensus among the expert panel. However, several comments from the experts suggested that there may not be as sharp of a delineation between the bench and supervisors as the questions suggested. During the Round Three survey (see Appendix A), two clarifying questions were incorporated to get a better understanding of how much overlap happens between reading and writing practices for the bench professionals and the supervisors.

All of these questions were presented to the MLS practitioners; however, so as not to create a longer survey and because practices specific for the bench and supervisor reached consensus among the expert panel, reading and writing were combined under bench and supervisor categories. The results from the MLS practitioners can be seen in Table 18. The level of agreement between reading and writing are separated for the experts in the first two practices, while the MLS practitioners were asked a combined question and the level of agreement is indicated. Because of the way this data is presented, a mean deviation score could not be established as the question could have been read and answered differently by the expert panel had the two practices been combined.

The second set of questions, which considered the potential overlap of practices between the bench and supervisor, was asked to both the expert panel in the Round Three survey of the Delphi project and the MLS practitioners. In this case, a mean deviation score could be established. The results of these analyses are presented in Table 16.

Table 16

MLS Practitioner Data Analysis. The Effect of the Role of the MLS Professional on Reading and Writing Practices – Level of Agreement (Expert Panel and MLS Practitioners) and Mean Deviation Score, Where Applicable

Reading and writing practices in MLS are different based on the role of the MLS in the laboratory

Bench MLS professionals read and write in limited and specific ways.

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts					
<i>Reading</i>	20.8%	4.2%	75.0%		24
<i>Writing</i>	4.2%		95.8%		
MLS Practitioners*	6.7%	5.4%	87.9%		224

Supervisor or management level MLS read and write in a broader way.

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts					
<i>Reading</i>	8.3%		91.7%		24
<i>Writing</i>	8.3%		91.7%		
MLS Practitioners*	2.2%	1.8%	96.0%		224

There is a lot of overlap between the supervisor and the bench. Supervisors have to be able to read and write the same things as the bench MLS professionals.

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	15.8%		84.2%		19†
MLS Practitioners*	9.8%	2.7%	87.1%	(0.4%)	223

Experts		MLS Practitioners*		Deviation Score
N	Mean	N	Mean	(Experts – Practitioners)
19	4.37	223	4.39	-0.026

There is a lot of overlap between the bench and the supervisor. Many bench MLS professionals are reading and writing the same things that the supervisors must read and write.

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	42.1%	10.5%	47.4%		19†
MLS Practitioners*	21.9%	10.3%	67.4%	0.4%	223

Experts		MLS Practitioners*		Deviation Score
N	Mean	N	Mean	(Experts – Practitioners)
19	3.11	223	3.8072	-0.702

*Experts identified in MLS Practitioner Survey Removed

†Expert responses from Round Three survey represented

Quantitative Analyses. There was a high level of agreement and consensus for three of the four practices for both groups. The level of agreement varied, from the minimum of 75% to over 90% agreement among both groups. For the reading and

writing practices specific to a particular role, whether bench professional or supervisor, both groups showed consensus and agreement with the statements, though the experts had a lower level of agreement with the idea that bench professionals read in a limited way, while they had a higher level of agreement for the limited writing practices of a bench professional. In addition there was a consistent level of agreement and a very low mean deviation score between the experts and practitioners for the idea of overlap in practices where *Supervisors have to be able to read and write the same things as the bench MLS professionals*. This supports a consistent level of agreement and consensus among the groups for this practice.

There was an exception for one of the practices, and that was the practice that suggested there is overlap between the bench and supervisors, where *Many bench MLS professionals are reading and writing the same things that the supervisors must read and write*. For both the experts and MLS practitioners, this practice did not reach consensus, though the MLS practitioners had a higher level of agreement, as demonstrated by the mean deviation score of -0.702, which was the highest level of deviation noted in this study. The negative value shows that the practitioners had more agreement with the statement compared to the experts, but there were significant differences in the level of the responses between the two groups where only 47% of the experts agreed with the statement, while 67% of the MLS practitioners agreed.

Qualitative Analyses. The comments associated with these practices are more reflective of the overlapping practices that occur with the bench professionals and supervisors. One respondent expressed concern about reasons why this type of overlap may be occurring:

[M]anagers or lab supervisors rarely can do any bench, but many department MLS heads do all of the bench in that area plus additional management duties. MLS bench techs (not dept [*sic*] heads) are having to do much of the dept. supervisor duties that the dep[artment] sup[ervisor] must allocate to them because they are busy doing corporate or management things. It's not a good use of employee resources nor their specific areas of expertise.

Another participant defended supervisors, suggesting that “a supervisor can’t do everything. If aren’t [*sic*] able to fill a role when someone has called out, or is unable to perform their duties for any reason, then you are not an asset to the team.” This participant may be presenting the idea that a bench professional should be able to step in when needed, which may include certain reading or writing practices normally considered to be a supervisor’s responsibility.

Other respondents had a different perspective, suggesting that overlap in these reading and writing practices supports the growth and development of MLS professionals so they can move beyond just being a bench professional; “ALL techs should have opportunities to perform and be involved in these practices so that they have the knowledge when their time comes to be in charge and manage.” This was echoed by another practitioner, who stated “bench techs should write SOPs both for their development and because they actually have the direct experience with performing the testing. The supervisor has to review and start the approval processes.” Since bench MLS professionals are actually performing the testing, it stands to reason that they would have the most current knowledge of a procedure, and any special exceptions related to the test method, which are all part of an SOP. A supervisor, who may not regularly sit on the bench and perform testing, may not have this experiential knowledge to write an effective SOP. One participant touted what students should learn during their education; “we

should educate them as generalists and with the competencies to write across bench and supervisory roles.” This participant suggests that entry level professionals should be ready to perform testing, but also have preparation for writing requirements at all levels within the laboratory hierarchy.

The hierarchy of the laboratory was mentioned by another practitioner, who indicated that the responsibility for certain disciplinary literacy tasks, as well as the bench work, fell along a continuum depending on the job category of the particular professional;

I am affiliated with a medical center that uses several "layers" of laboratory personnel. To my knowledge, the bench MLSs do not write much as part of their job, the technical supervisors write the SOPs and can work the bench. Managers are responsible for supervising personnel and budgets and can also work the bench.

This respondent suggests that there is a lot of overlap in who is able to perform the testing, but disciplinary literacy tasks are assigned to different MLS professionals, based on their job function. One respondent expressed their own experience with these tasks, stating “... as a bench MT I have never been asked [or] expected to ‘write’ anything.” In contrast, other MLS practitioners offered different experiences, where the overlap in practices and responsibilities among MLS professionals was significant. One stated “I am a bench tech but do many supervisor level tasks related to reading and writing,” while another indicated “bench techs in my institution perform many functions that are normal for supervisors at other institutions.” It is important to note that the type of tasks that are performed by bench professionals may be a reflection of the institution in which they work. This was posited by one respondent who stated “the variety of reading and writing duties of a bench tech also depend on the size, type, and kinds of services of the lab as well as, possibly, the amount of state restrictions.” These differences in locality and

institution type may have a profound effect on the types of additional reading and writing practices that bench MLS professionals are expected to perform.

MLS Practitioner Reading and Writing Experiences in Their Role

An additional question was asked in the MLS practitioner survey to determine the reading and writing practices respondents were actually experiencing in their own setting. The question asked them if, in their role, they performed reading and writing tasks associated with a bench MLS professional or a supervisor level professional, and asked whether they read and write beyond their official position. See Table 17 for details. The respondents could choose more than one answer, and each answer was counted, therefore there were more answers than the total number of participants.

Using the job description or institution setting provided by each of the MLS practitioners, each respondent was categorized as either a bench professional (bench), a bench but lead level professional (lead), a manager (manager), or an individual who works in education (education). Lead level professionals either listed themselves specifically as a lead MLS or indicated they were at a specialist or technical level. There was also an 'other' category, which was not included in Table 17 because the job titles represented research positions and other individuals who worked in non-clinical laboratories. While interesting, the primary focus for this study was on disciplinary literacy practice of MLS in clinical settings. Educators were included in this, as many times educators can be part of the clinical laboratory staff or are in a higher education setting, but work closely with laboratory professionals.

Once the respondents were categorized by job type, their response or responses to the question prompt were recorded. Thus if the individual was a bench professional and

indicated that they read and write as a bench professional would, the code applied was “bench bench.” If they felt that they read and write more like a manager, then the code was “bench manager” and if they felt they read and write beyond what is expected of their position the code was “bench beyond.” This same labeling system applied to leads, managers, and educators. If no response was recorded then a code of “no” was noted after the job category. If an individual chose more than one option, then each was recorded based on the identification scheme described.

The total number of responses for each of the possible labels was counted using the ‘countif’ function in Excel (Total Count). This resulted in 251 individual responses, demonstrating the fact that some respondents chose more than one option, and in some cases, chose all three. In order to understand how each job type perceived their reading and writing practices, the ‘countif’ function was again used to determine how many bench, lead, manager, and education job categories there were (Total # Participants in Job Category) which added up to 224, the total number of participants. The Total Count label for a particular job type and perceived reading and writing was divided by the total number of participants with that job type (% of Job Category) to get a sense of how those within a particular job type perceive their reading and writing practices. See Table 17 for results.

Table 17

Perceptions of MLS Practitioners of Their Reading and Writing Responsibilities Based on Job Category.

Job Category + Perception Read/Write	Total # Participants in Job Category	Total Count (Job + Perceived reading/writing)	% of Job Category
Bench:	107		
Read/write as Bench		69	64.49%
Read/write as Manager		28	26.17%
Read/write beyond position		19	17.76%
No response		2	1.87%
Bench (Lead):	13		
Read/write as Bench		4	30.77%
Read/write as Manager		9	69.23%
Read/write beyond position		2	15.38%
No response		0	0.00%
Manager:	35		
Read/write as Bench		4	11.43%
Read/write as Manager		33	94.29%
Read/write beyond position		4	11.43%
No response		0	0.00%
Education:	49		
Read/write as Bench		2	4.08%
Read/write as Manager		36	73.47%
Read/write beyond position		14	28.57%
No response		2	4.08%
Other (Not included)	20		
Total	224	251	

The results from the chart show a number of interesting perspectives among the MLS practitioners. Primarily, the results demonstrate the different views of the types of reading and writing that members of a particular job category feel that they perform. Approximately 65% of the bench MLS professionals felt that they read and write as is appropriate for their job. However 26% indicated that they read and write at a manager's level and approximately 18% felt that they read and write beyond their position. When considering the responses from lead MLS professionals, the percentages are quite different. Only 31% felt that they read as a bench professional, while 69% indicated that they read and write as a manager and 15% felt that they read and write beyond their

position. Taken together, approximately 43% of the bench MLS professionals feel that they are reading and writing in a way that is beyond their position, and 84% of the lead MLS professionals felt this way.

When compared to the practice *There is a lot of overlap between the bench and the supervisor. Many bench MLS professionals are reading and writing the same things that the supervisors must read and write*, the agreement level for this question among the MLS practitioners was 67%, which may represent an averaging of the perceptions between bench and lead MLS professionals. Whereas bench professionals are tasked with performing testing, lead MLS professionals are often tasked with more responsibilities, such as making the schedule, writing SOPs, training new employees, and they can serve as a liaison between the bench MLS professionals and supervisors or managers. Often lead MLS professionals have several years of experience on the bench and have a great deal of institutional knowledge, or they might be a specialist in one particular area of the laboratory such that they serve as an expert in that particular department. Thus, it is unsurprising that lead MLS professionals are reading and writing beyond what a bench professional might.

Responses from the managers demonstrated that most of the managers (94%) felt they were reading and writing in a way that was consistent with their job. Even the 11% who responded that they read and write as a bench professional was consistent, and though low, corresponds with the 87% of MLS practitioners that agreed with the idea that *There is a lot of overlap between the supervisor and the bench. Supervisors have to be able to read and write the same things as the bench MLS professionals*. Only a small

number of managers (11%) felt that they read and write in a way that was beyond what they should be doing in their job.

Educators were included in these data, even though some educators work in a higher education setting and others are educators within a hospital setting. In general, educators come from the clinical setting (Kotlarz, 1998c, 1999a; Miller, 2014), so they have experience as bench level professionals and beyond. The results confirmed that this particular question was not a good fit for the educators, since the categories presented were not a match for the educational setting. However, the majority (73%) felt that they read and write more like a manager, and 29% felt they read and write beyond what is required for their position. Some comments support these findings. One respondent indicated “as an educator, I read and [write] as a bench tech, supervisor and beyond to best prepare my students,” while another stated that “writing is an integral part of my job description to all levels of individuals inside and outside of the lab and University.” Given the requirements for publication, presentations, and preparing lectures and handouts for students, it is perhaps unsurprising that those in academia feel this way about the disciplinary literacy practices with which they participate.

The Effect of the Role of the MLS Professional in the Clinical Setting and Disciplinary Literacy Practices – Oral Communication

During the Delphi project, the expert panel indicated that certain oral communication practices may be limited to certain individuals, based on the role they had in the clinical setting. For instance, a supervisor or manager was perhaps more likely to communicate with the administration of a hospital compared to a bench professional. Another example given was that a public outreach coordinator would have more

interactions with community members or even legislators when compared to a bench professional. These concepts were explored in the MLS practitioner survey. Both practices reached consensus among the expert panel and the practitioners, though the experts had a higher level of agreement as compared to the MLS practitioners. See Table 18 for details.

Table 18

MLS Practitioner Data Analysis. The Effect of the Role of the MLS Professional on the Disciplinary Literacy Practices – Level of Agreement (Expert Panel and MLS Practitioners) and Mean Deviation Score, Where Applicable.

<i>Oral Communication practices in MLS are different based on the role of the MLS in the laboratory</i>					
Oral communication practices in MLS that are associated with administration of the hospital. Open communication between laboratory staff and the administration depends on the role that the MLS has in the laboratory.					
	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	15.8%		84.2%		19†
MLS Practitioners	8.5%	10.7%	79.9%	(0.9%)	222
	N	Mean	Deviation Score (Experts – Practitioners)		
Experts	19†	4.11			
MLS Practitioners	222	4.15	-0.043		
Oral communication practices in MLS that may be associated with legislators, community members, donors, etc. depends on the role of the MLS profession and is not typical for most MLS professionals.					
	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)	Total (# Participants)
Experts	5.3%	10.5%	84.2%		19†
MLS Practitioners	9.4%	13.8%	75.4%	(1.3%)	221
	N	Mean	Deviation Score (Experts – Practitioners)		
Experts	19†	4.21			
MLS Practitioners	221	4.04	0.174		
	Experts		MLS Practitioners*		
	N	Mean	N	Mean	
	19	4.21	221	4.04	

*Experts identified in MLS Practitioner Survey Removed
 †Expert responses from Round Three survey represented

Quantitative Analyses. Both questions reached consensus among the expert panel and the MLS practitioners, though the level of agreement among the experts was 84% for both questions, while the MLS practitioners had a level of agreement between 75%-80% between both questions. The absolute mean deviation between the two questions was quite low at < 0.2 . This supports a consistent level of agreement and consensus among the groups for these practices.

Qualitative Analyses. The comments revealed some interesting perspectives from the MLS practitioners, particularly as they relate to communicating with the administration of the hospital. Some also addressed communication with legislators and community members as well. One respondent also suggested that “communication with study directors” be added to one of these practices, or be established as a separate practice. This could be included under the practice *Oral communication practices in MLS that are associated with administration of the hospital*, and could be adjusted to include those that administer or direct clinical research. While not all hospitals participate in clinical research, those that do would have to communicate with the project directors as necessary.

There were several comments addressing communication with the administration of a hospital. Two MLS practitioners indicated that, while they do not communicate regularly with the administration, they could if necessary. One stated “while I may not communicate with these entities at the present time, I should be able to if the need arises,” and the other has a similar sentiment; “I can communicate with the administration of the hospital if I need to but don't do it regularly.” Another participant felt that, although it is true that certain roles are more likely to communicate with the

administration, this was perhaps unfair as there could be those in the bench level positions who would have valuable insights and ideas to share and suggested “supervisors or managers usually perform these communication roles: they are not tied to [bench work]; unfortunately, titles of Manager or Supervisor help to elevate acceptance from other professions; talented bench workers in this area are overlooked.” This practitioner felt that all positions in the laboratory should be able to communicate with the administration and others in healthcare, not just the supervisors, but unfortunately it does not happen often.

While these participants felt that they had an avenue to communicate with their administration, others felt that communication was lacking. One respondent revealed that “there is not enough oral communication between administration and the bench.”

Another participant went into more detail, expressing deep concerns about the response from the administration and a lack of respect and support for the work performed in the laboratory:

We have periodic "Town Hall" meetings with upper VP [vice president] administration yet when any issue or concern is brought up they typically do not listen and very quick to shut down the topic. Lab is not big money maker for the institution although the major source many times for diagnosis yet upper management still refuses to recognize the importance and education we receive and still think of lab as "button pushers" that anyone off the street can do. Our budgets are always cut[,] our staffing is always extremely low, (due mostly to low pay scales) and it is even hard to get any supplies approved such as refrigerators, freezers etc. when they are no longer functional.

This respondent clearly felt that the administration was more concerned with financial concerns such that the needs of the laboratory were not being met adequately. Proper funding for salaries and equipment were not being supported and the education required for a laboratory professional to work in the laboratory was not recognized. It is very

likely that this environment has a profound effect on the professional identity of these laboratory employees.

Some MLS practitioners also presented their experiences with communicating with legislators as well as community members. One participant indicated that they communicated more frequently with community members, and not legislators, stating "...while I don't communicate with legislators, I communicate periodically with administrators and very regularly with community members." Another respondent expressed a similar sentiment, indicating "I am now retired but when employed rarely talked with legislators but frequently talked with community members, etc. Again the size and location (large urban/small rural) of the facility heavily influences communication." In this case, the participant pointed to the size of an institution having an effect on the level and type of communication. Smaller hospitals or those in rural settings may have more access and interaction with community members as compared to larger hospitals or those in more urban locations. Another participant, who indicated they were "a Director of a department," provided an example of how their role in the hospital afforded them various experiences with groups outside of the hospital setting. When it came to community members, this individual stated "I also sit on our hospital's foundation board so in this capacity and communicate with donors and community members at least monthly." It seems, in this case, the individual's position in the hospital gives them access to certain groups outside of the hospital.

This same Director also talked about becoming more interested in the legislative process, indicating "I have gotten involved this year and have [started] to communicate with my legislators on a more regular basis and did go to Washington DC to meet with

the staff.” Another respondent indicated that they communicate with legislators, but not as a part of their work, stating “I communicate with legislators, etc. outside of my role at the hospital. I do this through the professional organization.” Professional organizations and their involvement with legislative issues was also mentioned by another participant, who had made a choice to remain uninvolved:

I choose not to take an active [role] in the professional organizations that have an active [role] in meeting with legislators and those in government that regulate the industry, I do know several bench techs that are involved in this manner. Working a bench vs being a supervisor is not a deciding factor on involvement, I think the deciding factor is personal choice.

This participant suggested that communicating with legislators is less about the role of the MLS professional, and more about interest on the part of the individual. Certainly if an individual chooses to become involved with a professional organization it shows a particular type of interest, since membership is not a requirement for employment and often member fees are paid by the individual rather than their employer. It may be that, as the role of an MLS professional changes throughout their career, they develop an interest in participating with legislative issues or in interacting with community members.

MLS Practitioner Oral Communication Experiences in Their Role

As with the reading and writing practices that were actually experienced by the MLS practitioners, an additional question was asked to determine if, in their role at their institution, the participants were communicating with their administration or legislators/community members regularly, or not. See Table 19. The respondents could choose more than one answer, and each answer was counted, therefore there were more answers than the total number of participants.

The categorization and analysis of these responses were performed in much the same way as the reading and writing practices experienced in their role. The job description or institution setting provided by each of the MLS practitioners was considered and they were categorized as either a bench professional (bench), a bench but lead level professional (lead), a manager (manager), or an individual who works in education (edu). Again, the ‘other’ category was not included in Table 19 because the job titles represented positions outside of the clinical laboratory. However, educators were included.

Once the respondents were categorized by job type, their response or responses to the question prompt were recorded. Thus if the individual was a bench professional and indicated that they communicate regularly with their administration, the code applied was “bench admin.” If they communicated regularly with legislators, community members, or donors, then the code was “bench comm” and if they identified that they did not communicate with either group regularly the code was “bench no.” This same labeling system applied to leads, managers, and educators. If no response was recorded then a code of “no response” was listed before the job category. If an individual chose more than one option, each was recorded based on the identification scheme described.

The total number of responses for each of the possible grouped labels (Total Count – job and perceived oral communication interactions) was counted using the ‘countif’ function in Excel. This resulted in 241 individual responses, demonstrating the fact that some respondents chose more than one option. In order to understand how each job type perceived the type of communication they participate in, the ‘countif’ function was again used to determine how many bench, lead, manager, and education job

categories there were (Total # Participants in Job Category). The grouped label for a particular job type was divided by the total number of participants with that job type (% of Job Category) to get a sense of how those within a particular job type perceive the communication they perform. See Table 19.

Table 19

Perceptions of MLS Practitioners of Their Oral Communication Interactions Based on Job Category.

Job Category + Perception of Communication	Total # Participants in Job Category	Total Count (Job + Perceived oral communication)	% of Job Category
Bench:	107		
Communicate regularly with administration		18	16.82%
Communicate regularly with legislators, community members, donors, etc.		5	4.67%
Do not communicate with either group		85	79.44%
No response		1	0.93%
Bench (Lead):	13		
Communicate regularly with administration		3	23.08%
Communicate regularly with legislators, community members, donors, etc.		0	0.00%
Do not communicate with either group		10	76.92%
No response		0	0.00%
Manager:	35		
Communicate regularly with administration		29	82.86%
Communicate regularly with legislators, community members, donors, etc.		6	17.14%
Do not communicate with either group		6	17.14%
No response		0	0.00%
Education:	49		
Communicate regularly with administration		15	30.61%
Communicate regularly with legislators, community members, donors, etc.		20	40.82%
Do not communicate with either group		15	30.61%
No response		6	12.24%
Other (Not included)	20		
Total	224	241	

One primary finding from these data were that, for the most part, those that work on the bench do not interact in a consistent way with either the administration or legislators/community members. Respondents that were identified as being bench professionals and leads did not communicate at a rate of 79% and 77%, respectively. Some in these job categories did indicate that they communicate with their administration, and more often the leads were in contact (23%), while only 17% of bench professionals were communicating with their administration. Very few indicated that they communicate with legislators or community members.

In contrast, the managers indicated a high level of communication with their administration, where 83% participated in this type of communication. Few managers communicated with legislators or community members (17%) and it was uncommon for managers to have no communication with either group. This is consistent with the findings from the practice *Oral communication practices in MLS that are associated with administration of the hospital depends on the role that the MLS has in the laboratory (e.g. only supervisors and/or managers may participate in this type of communication)* where nearly 80% of the MLS practitioners agreed with the statement.

The results from the educators proved interesting in that this group was more likely to interact with legislators or community members as compared to the other groups, where 41% indicated this type of communication. In addition, 31% participated in regular communication with the administration, though it was not immediately clear if this was hospital administrators or the administration of their higher education institution. In the case of the educators, 31% indicated that they do not communicate with either group, and a relatively large percent (12%) of the educators did not respond to this

question. This was the highest level of non-response among the different job categories. Given that educators are often recruiting potential students or working with hospitals to find clinical sites for students, these findings are perhaps not that surprising.

Professional Identity among MLS Practitioners

The final set of questions presented to the MLS practitioners was related to professional identity. These questions asked the participants to consider their own perceptions about themselves as a professional and the profession in general. See Table 20. These statements had been modified from previous studies (Doig & Beck, 2005; Short & Rinehart, 1992) that examined professional identity both in MLS and teacher education. The questions were presented to the participants using a 5 point agree-disagree Likert scale, but the results were consolidated into percentages based on a 3 point agree-disagree scale.

Table 20

Perceptions of Professional Identity among MLS Practitioners – Level of Agreement

	Disagree (%)	Neutral (%)	Agree (%)	Missing (%)
I believe I am an important member of the healthcare team	2.7%	2.2%	94.6%	0.4%
I am an active member of a professional organization or association (beyond credentialing)	25.9%	12.1%	61.6%	0.4%
I am given opportunities for continuing professional development at my institution	15.2%	9.4%	74.1%	1.3%
I stay up to date on the current legislation and regulations that apply to the clinical laboratory	12.5%	10.7%	75.9%	0.9%
I attend professional meetings / conferences / workshops on a regular basis	28.1%	12.5%	58.9%	0.4%
I am given the opportunity to teach other laboratory professionals, other healthcare professionals, or pre-professional students	11.2%	9.8%	78.1%	0.9%
I interact well with other members of the healthcare team	1.3%	4.5%	93.3%	0.9%
I read professional journals on a regular basis	14.3%	11.2%	73.2%	1.3%
I am treated as a professional in my institution	17.9%	11.2%	69.6%	1.3%
I have a good relationship with the other members of the healthcare team	4.5%	9.4%	85.3%	0.9%
I am respected in my institution	14.3%	14.7%	70.1%	0.9%
I am proud of the work I do as a member of this profession	0.4%	2.2%	96.0%	1.3%
I believe I have a responsibility to promote the MLS profession to others	2.2%	4.5%	92.9%	0.4%
I believe the general public is familiar with my profession and the role we play in healthcare.	83.5%	10.3%	5.8%	0.4%

Of the 14 statements, only seven achieved a level of agreement that would be considered consensus ($\geq 75\%$). A high level of consensus ($> 90\%$ agreement) was

achieved for the following statements; *I believe I am an important member of the healthcare team, I interact well with other members of the healthcare team, I am proud of the work I do as a member of this profession, and I believe I have a responsibility to promote the MLS profession to others.* A lower level of agreement (between 75% and 89%) was noted for the following statements; *I stay up to date on the current legislation and regulations that apply to the clinical laboratory, I am given the opportunity to teach other laboratory professionals, other healthcare professionals, or pre-professional students, and I have a good relationship with the other members of the healthcare team.*

One of the MLS practitioners supported the levels of agreement with these professional identity statements by saying “I was a bench tech, lab supervisor and Program Director during my career and I could not be happier with my chosen profession.” However, others expressed some reservations. One respondent expressed that they like their profession, but with some caveats; “VERY few people comprehend what we do. I like what I do, but will go to my grave believing we are underpaid and [underappreciated].” Another suggested that what they do is important, but individually they do not feel valued; “I believe my job function is important, I don't believe I am important. A different person who was as professional as me would fill the role just as well.” In this case, the participant felt that the work performed in the laboratory was important, but they do not appear to feel valued as a member of the profession, contrary to the high agreement levels. A high number of participants (93%) felt they had a responsibility to promote the profession, but one participant commented in a distinctly negative fashion, stating “I do NOT recommend CLS to young persons looking for a career.” It seems this individual may be an anomaly as there was a high rate of agreement for this statement.

Lower levels of agreement (between 58% and 75%, and therefore not reaching consensus) were noted for the following statements; *I am an active member of a professional organization or association (beyond credentialing), I am given opportunities for continuing professional development at my institution, I read professional journals on a regular basis, I am treated as a professional in my institution, and I am respected in my institution.* The lowest of these was *I am an active member of a professional organization or association (beyond credentialing)* at 62% agreement, which was supported by previous comments provided by the MLS practitioners. The statement *I attend professional meetings / conferences / workshops on a regular basis* received 59% agreement among the respondents. These two statements seem to be related, in that if a professional is not afforded opportunities to attend continuing education, they may not be able to attend conferences regularly. This idea was supported by the comments from the MLS practitioners. Two respondents indicated a lack of support for continuing education by their administration. One participant, who indicated they worked at a teaching facility, stated “we are no longer allotted funds to attend meetings, conferences etc. so it is not monetarily feasible to travel and hotel stay, fees etc. for us to do so,” while another MLS practitioner commented on the dangers of a lack of support from the administration;

Institutions that do not provide regular and relevant professional education to their employees will not help their employees to reach their maximum professional potential. This is harmful to the institution and unfortunately happens often. Continuing education should be a top priority for a lab but in reality it is often not budgeted for adequately.

Two other respondents considered broader concerns, particularly as they relate to changes in the way administration may view the importance of the education and training of those

in hospital laboratories and discrepancies in how individuals who are interested in expanding their education may be compensated:

In the advent of changing and absorbing healthcare workers into a title of Allied Health it takes away our individual identity. As [soon] as they accomplish this [standardization] of titles [there] goes any monetary advantages for higher [education] in healthcare.

This participant expresses concern about losing the MLS professional identity under an umbrella of ‘allied health,’ which could lessen the value of the MLS education. Another respondent also considers the devaluing of the MLS education:

It is unfortunate that working in healthcare, MT/MLT employees are not seen as part of the front line in healthcare service. Administration in almost all the places I have been employed have treated the laboratory as a department that do not need to [give] much support to. They fail to realize that our education is as good or better the nursing profession, they do not give remedial college classes to get into [a] program. Assuming that anyone without MT/MLT education can be train[ed] to work in a lab with the complexity of laboratory instrumentation, interpretation of results, budget, shift coverage, differential reading of blood smears, reading microbiology plates and sensitivities, cutting, processing, staining pathological specimens, writing policies and procedures, understanding CAP, Joint [Commission] and State regulations is a foolish and dangerous situation for healthcare.

This MLS practitioner clearly felt that not acknowledging the MLS education or the important functions that laboratory professionals provide was a cause for concern. In addition to this, one respondent commented on the statement that they are respected in their institution, countering this idea by stating “in our institution we respect each other, yet get very little respect from other departments. Some physicians do respect us but as a whole, no we are not respected in the least.” This lack of respect, from the administrations to others in healthcare, has been a concern among MLS professionals for many years.

Unsurprisingly, the statement *I believe the general public is familiar with my profession and the role we play in healthcare* had the lowest level of agreement (6%), acknowledging that the MLS profession is not well known to the general public. There were several comments related to this from the respondents and considered not only the general public, but also other clinical staff that work directly with patients. One participant stated “People think if you work in the lab, you draw blood. Even our co-professionals, such as nurses, are unaware that we have a bachelor's degree and an extended amount of time (1 year/40 hrs. a week) in clinicals.” This same observation was presented by another MLS practitioner, who posited “we are all thought of as phlebotomists. No one knows we have as much and sometimes more education levels than nursing.” Since phlebotomists, and sometimes laboratory professionals tasked with drawing blood, are generally the only representatives from the laboratory to interact with patients, it is easy to see why there would be this perception. Another participant agreed, indicating “the general public does not know/understand what an MLS does. The health professionals that [*sic*] interact with the patients are the ones who get the acknowledgements. I believe the nurses and even doctors, have no idea what we actually do.” This lack of recognition by other members of healthcare may have an effect on the previous concerns about respect for the MLS profession at an institution. This sentiment was supported by one respondent, who stated “lack of knowledge and respect for what we do among other healthcare professionals is my biggest complaint. I am continuously educating them regarding our level of education and certifications.” The lack of recognition is likely affected by the fact that many laboratory professionals rarely interact

with patients and others on the healthcare team, instead preferring to remain in the laboratory:

I think many people do not know how important lab professionals are and how important our role is in any healthcare outcome. We provide results to providers so that may treat their patients. We are the "behind the scenes" and sometimes are overlooked by administration and other departments in the organization.

Perhaps one of the difficulties in understanding the MLS profession, for both healthcare professionals and the general public, is due to the variability among laboratory departments, staffing titles, and degrees. This was demonstrated by one respondent:

Our profession is so diverse it is really hard to explain to the general public. With so many facets[:] 2 [year] [degree] MLT, 4 [year] degree MT/MLS, [generalists], larger reference facilities we have Specialists in BB, Micro, Chemistry, [cytotechs], histotechs [*sic*]. Just explaining that takes time and their interest can wain so if you just stick to what you do often we are not able to promote our other members.

The idea that the public can become confused about all the different areas and titles within the laboratory was echoed by another MLS practitioner, who indicated "the general public's view of the laboratory is challenging to change. I repeatedly tell the same people what I do and they still ask or are confused." However, one participant, who indicated they work in education, feels that perhaps public sentiment is beginning to change:

I work in education so I don't spend much time interacting with other healthcare professionals in the hospital setting, but I do work closely with others teaching allied health professions in my organization. I think the public is beginning to recognize us because I am getting more inquiries and seeing more applications to my program from people that have no background in science at all who are suddenly interested in a career in clinical laboratory science.

Without more information about why this might be, it is difficult to determine why this individual is seeing an increase in interest for the profession. However, with a current

shortage in MLS professionals that is only projected to get worse in the coming years, it was a positive observation.

Bivariate Analyses of Professional Identity. Because several of the statements that the MLS practitioners evaluated in relation to their professional identity had similarities or could be related to one another, a correlation of two variables using Spearman's rho was performed. This correlation was performed to see how related some of these variables actually were, or if there was no association. Only a selected group of these analyses are presented. See Tables 21, 22, 23, and 24. Values considered for correlation levels were weak (< 0.1), modest (< 0.3), moderate (< 0.5), strong (< 0.8), and very strong (≥ 0.8) (Muijs, 2011).

Most of the correlations examined were modest to moderate in strength, except for those that were compared to the perception of whether the general public knows about the MLS profession. Some interesting results did come about, especially as it relates to the MLS practitioners' perceptions of being treated as a professional, being given opportunities for continuing education, being a member of a professional organization, having opportunities to teach others, and feeling proud to be a MLS professional. Each will be addressed below.

Table 21 presents the correlations related to the MLS practitioners' perceptions of feeling that they are treated like a professional.

Table 21

Correlation Values using Spearman's rho – MLS Practitioners' Perceptions of Being Treated as a Professional

	I am treated as a professional in my institution	
I interact well with other members of the healthcare team	<i>Correlation Coefficient</i>	.238**
	<i>Sig. (2-tailed)</i>	.000
	<i>N</i>	221
I have a good relationship with the other members of the healthcare team	<i>Correlation Coefficient</i>	.584**
	<i>Sig. (2-tailed)</i>	.000
	<i>N</i>	221
I believe I am an important member of the healthcare team	<i>Correlation Coefficient</i>	.279**
	<i>Sig. (2-tailed)</i>	.000
	<i>N</i>	221
I am respected in my institution	<i>Correlation Coefficient</i>	.751**
	<i>Sig. (2-tailed)</i>	.000
	<i>N</i>	221

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

All showed significance at $p < 0.01$, but the correlation coefficients were varied. Where *I interact well with other members of the healthcare team* was only modestly correlated (0.238), *I have a good relationship with the other members of the healthcare team* was strongly correlated (0.584). Similarly *I believe I am an important member of the healthcare team* was only modestly correlated (0.279) while *I am respected in my institution* was strongly correlated (0.751). These differences are interesting because interacting with and having a good relationship with others on the healthcare team do not seem to be very different in concept, but in this case the level of correlation was quite different as it related to being treated as a professional. It would also stand to reason that being an important member of the healthcare team and being respected would have a strong relation to being treated as a professional, but that was not the case when comparing the respondents' feelings about their importance on the healthcare team.

Many of these differences may have been affected because of the lower level of agreement (70%, see Table 20) among the MLS practitioners associated with being

treated as a professional, where higher levels of agreement (> 90%) were recorded for believing they are important members of the healthcare team and believing they interact well with other members of the healthcare team.

Table 22 presents the correlations related to the MLS practitioners' participation in professional organizations and opportunities for professional development.

Table 22

Correlation Values using Spearman's rho – MLS Practitioners' Perceptions of Professional Organizations and Continuing Education

	I am an active member of a professional organization or association (beyond credentialing)	
I attend professional meetings / conferences / workshops on a regular basis	<i>Correlation Coefficient</i>	.612**
	<i>Sig. (2-tailed)</i>	.000
	<i>N</i>	223
I stay up to date on the current legislation and regulations that apply to the clinical laboratory	<i>Correlation Coefficient</i>	.456**
	<i>Sig. (2-tailed)</i>	.000
	<i>N</i>	222
	I am given opportunities for continuing professional development at my institution	
I attend professional meetings / conferences / workshops on a regular basis	<i>Correlation Coefficient</i>	.458**
	<i>Sig. (2-tailed)</i>	.000
	<i>N</i>	221

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

When considering professional organizations and opportunities for professional development, moderate to strong correlations were seen and were statistically significant ($p < 0.01$). These data show that being a member of a professional organization had a stronger correlation (0.612) to attending professional meetings, compared to a more moderate correlation (0.458) when institutions offered opportunities for professional development. Being a member of a professional organization was also moderately correlated (0.456) with keeping current with legislation that affects the laboratory. These correlations make sense, as professional organizations generally will have journals and

conferences to share information among members. If an MLS professional chooses to be a member of a professional organization, it is likely that they have an interest in attending conferences and reading the professional literature from the organization. In addition, if an institution supports professional development, it makes sense that these professionals would have more opportunities for conference attendance.

Table 23 presents the correlations related to the MLS practitioners' perception of being able to teach both students and other healthcare professionals.

Table 23

Correlation Values using Spearman's rho – MLS Practitioners' Perceptions of Teaching Students and Other Healthcare Professionals

	I am given the opportunity to teach other laboratory professionals, other healthcare professionals, or pre-professional students	
I am proud of the work I do as a member of this profession	<i>Correlation Coefficient</i>	.226**
	<i>Sig. (2-tailed)</i>	.001
	<i>N</i>	220
I believe I have a responsibility to promote the MLS profession to others	<i>Correlation Coefficient</i>	.167*
	<i>Sig. (2-tailed)</i>	.013
	<i>N</i>	222

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

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

Results from these analyses were quite stark. Approximately 78% of the MLS practitioners indicated that they have been given opportunities to teach at their institutions (see Table 20), but when compared to whether they are proud of the work they do, the correlation is only modest (0.226, $p < 0.01$). This is likely due to the high level of agreement (96%) to the statement that they are proud of their work as an MLS professional. There was an even lower correlation, but still modestly correlated (0.167, $p < 0.05$) with the idea that those that have an opportunity to teach also have a responsibility to promote the profession. Again, the agreement level for promoting the

profession was high at 93%, which may explain these results. Opportunities for teaching may include training of new employees or teaching pre-professional students. These opportunities may vary depending on the individual and the role they play in the laboratory. For instance, a lead MLS may be expected to teach more often than a bench professional. Teaching may also vary between institutions. Research or private physician office laboratories may only train new employees and infrequently, while hospital laboratories train both students and employees.

Table 24 presents the correlations related to the MLS practitioners' perceptions of being proud to work as an MLS professional.

Table 24

Correlation Values using Spearman's rho – MLS Practitioners' Perceptions of Being Proud of the Work They Do as a Member of the Profession

	I am proud of the work I do as a member of this profession	
I believe I am an important member of the healthcare team	<i>Correlation Coefficient</i>	.040
	<i>Sig. (2-tailed)</i>	.554
	<i>N</i>	219
I believe I have a responsibility to promote the MLS profession to others	<i>Correlation Coefficient</i>	.381**
	<i>Sig. (2-tailed)</i>	.000
	<i>N</i>	221

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

These results were also revealing, as only a moderate correlation (0.381, $p < 0.01$) was associated with being proud of their work and having a responsibility to promote the profession. No correlation was found when examining whether the MLS practitioners were proud of their work and whether they felt like an important member of the healthcare team. This was rather startling, because both of these statements had > 90% agreement among the MLS practitioners (see Table 20).

Conclusion

Overall, the findings show that the MLS practitioners agreed with most of the disciplinary literacy practices identified in the Delphi project. In addition, a new practice was revealed related to visual cues for hearing impaired professionals. Established practices, such as maintaining a continuity of services verbally, were enhanced with additional details. For example, extending the concept of maintaining a continuity of service to communication between different departments in the laboratory or even between laboratory staff in different hospitals within a healthcare system. One practice, related to communicating with patients, that had previously caused some concern among the expert panel and had not reached consensus were identified as an area where no consensus was reached among the MLS practitioners as well, showing consistency among both groups.

The questions associated the MLS practitioners' perceptions of the disciplinary literacy practices they actually perform in their role at their institution revealed that, while most professionals are using practices consistent with their role, there are specific roles, such as the lead MLS professionals, that perform practices that are above and beyond what may be expected of their position at their institution. These may have implications for job descriptions, expectations related to workload among MLS professionals, and education of pre-professional MLS students.

Findings from the professional identity questions suggest that, while MLS professionals feel that they are important and they are proud of what they do, this is not matched in their experiences in their institutions. In addition, the perception among most of the MLS practitioners is that the general public, as well as the administration and

others in healthcare, are largely unaware of the profession. This could offer an opportunity for improvement, both in institutions as well as with the general public, to educate others about laboratory professionals and the important work that they perform.

CHAPTER 6

DISCUSSION AND IMPLICATIONS

Significance of the Study

While the area of disciplinary literacy has become a focus for educational researchers in the last two decades (McConachie & Petrosky, 2010; Moje, 2007), there have been few studies that have defined disciplinary literacy in a particular profession or discipline (Brill et al., 2007; Frick, 1990). Some studies have focused on and defined particular practices, such as reading or writing, and examined these practices among several disciplines, such as history, science, English, and others (Carter, 2007; C. Shanahan et al., 2011). The research conducted in this study identified and defined the specific disciplinary literacy practices, including the reading, writing, and oral communication practices, connected to the highly analytical and technical profession of MLS. In addition, this study examined the professional identity of MLS professionals, and sought to understand how the discipline's literacy practices might be connected to the identity of MLS professionals.

The Delphi method (Hasson et al., 2000; Linstone & Turoff, 2002; Maxey & Kezar, 2016) offered an innovative way to explore and define these practices, using the input from experts in the profession. Although this method has been used before to define the literacy of two different disciplines (Brill et al., 2007; Frick, 1990), it had not been used in this way for MLS. The identified disciplinary literacy practices from the MLS expert panel were corroborated by other MLS practitioners, who represented all levels of experience in the profession and were from all across the United States and around the world, demonstrating the universality of these practices in the profession.

These practices can be used by MLS educators, as well as current laboratory professionals, to better understand and communicate about the MLS profession.

Identified Disciplinary Literacy Practices of MLS

The following represents the complete list of disciplinary literacy practices for MLS as defined by the MLS expert panel and in consensus with the MLS practitioners. Each of the three areas associated with disciplinary literacy (reading, writing, and oral communication) are represented.

Reading Practices

1. Reading practices in MLS relate to keeping informed.

a. Reading is done to answer a question or solve a problem.

For example, patient sample testing and results may require use of technical manuals, textbooks, or journal articles.

b. Reading is done to stay up to date on current issues in medicine, testing, and procedures.

For example, professional journals, continuing education modules and webinars, mandatory or compliance training, conferences, newsletters, or communication provided by administration or supervisors.

c. Reading is done to learn about and review new technologies, products, instruments, or textbooks.

This is done in order to review the product for purchase or to learn about a new instrument or product that is being introduced into the laboratory setting.

d. Reading is done to prepare or remain knowledgeable in order to teach students and/or coworkers and others in healthcare.

2. Reading practices in MLS relate to evaluation and action.

- a. Reading patient results requires interpretation and analysis of the results.

The MLS professional must determine if results are acceptable and in range, and must make decisions about additional manipulation of the samples (e.g. Dilutions).

- b. Reading an instrument manual or product insert is required for using instruments, kits, or other reagents.

Results produced must be evaluated and interferences or errors are understood by reading the information provided by the manufacturer.

- c. Reading standard operating procedures (SOPs) provides detailed information for performing tests and communicating results to clinical staff.

The manufacturer-provided information for an instrument, kit, or reagent are primary resources for these documents.

- d. Reading and evaluation of quality control and calibration results must be completed prior to patient testing

This is done to confirm the test system is working appropriately and providing accurate results for patients.

- e. Reading is done to troubleshoot the problem

When pre-analytical errors occur, when patient results are not consistent, or when instruments present errors.

3. Reading practices in MLS include systems that do not require written words (semiotic systems).

- a. Reading involves understanding auditory cues, such as timers, alarms, buzzers, etc.
- b. Reading involves interpretation of numbers and numerical values in a wide variety of contexts.

Measuring devices, patient results, and budget information.

- c. Reading involves visual analysis, which includes:
 - i. Graphical representations, such as tables, flow charts, diagrams, or data generated by certain instrumentation (e.g. hematology cell scatterplots).
 - ii. Images, such as safety symbols, visualization through a microscope, or images used for comparison or interpretation of results.
 - iii. Visual cues, such as flashing lights, for those MLS professionals who are hearing impaired.
 - iv. Reading patient results that require interpretation of color changes, agglutination, colony formation and growth patterns on agar, cell morphology, stain results, etc.
 - v. Interpretation of whether the results are correct or incorrect. For example determining if the stain is correct; if color changes are reliable; if agglutination is appropriate; or if analysis of agar determines growth is normal flora, pathogenic, or contamination.

Writing Practices

1. Writing practices in MLS directed at an audience inside the clinical workplace have particular purposes.
 - a. Writing is done to maintain a continuity of services.

e.g., communication between all shifts to share information about patients and instruments.

- b. Writing is done to document a wide variety of things in the laboratory.
Including critical results, quality control and calibration results, instrumentation processes and procedures (instrument logs), and patient sample issues and instrument troubleshooting.
 - c. Writing is done to record patient results.
May include additional information that must be shared with the clinical staff including interferences and notifications related to interpretation.
 - d. Writing of standard operating procedures (SOPs) is done to provide a step-by-step process for running an instrument or test method.
 - e. Writing policies outlines the overall guidelines for the daily processes of the laboratory.
 - f. Writing orders enables the lab to purchase necessary supplies and equipment.
 - g. Writing is done to communicate with and between personnel.
Includes email, evaluations, competency assessments, schedules, disciplinary actions, incident reports, and justifications for new products or instrumentation.
2. Writing practices in MLS directed to an audience outside the clinical workplace have particular purposes.
 - a. Professional writing is done for other professionals outside of the clinical setting.
May include journal articles, editorials, continuing education modules, or case studies.

- b. Writing for accreditation or regulatory bodies is done to meet the requirements to maintain accreditation and regulation.
 - c. Writing is done by MLS professionals and educators to convey information to students.
3. Writing or production practices in MLS relate to systems that do not use written words (semiotic systems):
- a. Writing involves numbers associated with patient values, budgets, etc.
 - b. Writing involves visual representations, such as:
 - i. The production of diagrams, flow charts, graphs, etc. to convey information.
 - ii. The production of images, including still pictures, animations, videos, etc.

Oral Communication Practices

1. Oral communication practices in MLS occur between coworkers in the laboratory.
 - a. Oral communication practices are done to maintain a continuity of service so that patient care continues seamlessly between shifts.

This includes communication to keep up to date on current practices, to discuss breaks and covering shifts, and between departments in the laboratory and other laboratory sites within a larger healthcare system.
 - b. Oral communication practices are done to communicate information about instruments and reagents.

Includes instrument or reagent status, quality control, calibration, etc.
 - c. Oral communication practices are for problem solving.

This includes communication between coworkers related to patient samples, results, or instrument troubleshooting.

- d. Oral communication practices are done for training.

This relates to communication that occurs when training a new employee.

- e. Oral communication practices are done between bench level MLS and supervisors / managers.

Communication happens either from the bench level MLS to the supervisor / manager or the supervisor / manager to the bench level MLS.

2. Oral communication practices in MLS occur between the laboratory staff and clinical staff.

- a. Oral communication practices are done to convey information.

This may be reporting a critical value, explaining test results, providing advice on ordering the correct test or follow up tests, blood product availability, concerns about patient reports or values, or other specifics related to patients and patient care.

- b. Oral communication practices are done to ask or answer questions.

These may be questions coming from the laboratory staff to the clinical staff, or from the clinical staff to the laboratory staff.

3. Oral communication practices in MLS occur between the laboratory staff and others associated with healthcare.

- a. Oral communication practices are associated with instrument purchasing and maintenance.

This occurs both inside and outside of the hospital, including manufacturer sales, service representatives, or technicians.

- b. Oral communication practices are associated with other service providers such as couriers or other delivery personnel.
 - c. Oral communication practices are associated with reference and state laboratories.
This communication is necessary for external testing on patient samples requiring more complex test methods or for test methods that are not performed at the clinical laboratory.
 - d. Oral communication practices are associated with peer laboratories.
This communication means comparing methods and protocols, quality improvement, accreditation, education and training among peer hospitals.
4. Oral communication practices can be associated with education.
- a. Oral communication practices are related to continuing education, including presentations for other MLS professionals.
 - b. Oral communication practices are related to teaching students.
This may be in the laboratory setting or in a classroom setting. May include pre-professional MLS students, high school, and/or middle school students.

Multimodality of the Disciplinary Literacy of MLS

- 1. Both oral communication and written communication are used together for:
 - a. Continuity of service.
For example, huddles and verbal ‘hand offs’ at shift change (oral communication) and communication logs and emails (written communication) which then have to be read by those who may come in during ‘off’ shifts.
 - b. Communication with others associated with healthcare.

For example, communication with reference labs and vendors requires both oral communication and written communication for documentation as a reference.

- c. Continuing education and teaching students, which can be presented online
Uses both a written format (e.g. PowerPoint, handouts) and a recorded presentation (oral communication).

Implications and Recommendations

Two areas were explored in this research project; disciplinary literacy practices and professional identity. Both areas will be addressed.

Disciplinary Literacy Practices and Discourse of MLS

Findings from this study revealed a particular Discourse (Gee, 2015b) and the specific disciplinary literacies of the MLS profession. Many of the primary themes could apply to several different disciplines or professions. For example, *Reading practices... relate to keeping informed*, could apply to a wide variety of professions. The theme *Writing practices... directed at an audience inside the... workplace have particular purposes* also applies in many different disciplines, and *Oral communication practices... occur between coworkers...* is certainly a very common occurrence in every workplace setting. However, it is the specific practices associated with each theme that demonstrate the unique Discourse of MLS.

Results from this study show the range and variety of the types of reading, writing, texts, and oral communication practices that are vital for the profession. They also demonstrate that many of the disciplinary literacy practices are multimodal, where reading, writing, and oral communication are intermixed as part of the Discourse. These conclusions offer laboratory professionals insights into the practices they perform each

day, making them unambiguous. Although many of these practices are familiar, or as one participant stated “obvious,” many of them have generally been learned over time and are not explicitly taught.

Disciplinary Literacy Practices in the Clinical Setting. For the laboratory professionals who teach pre-professional students, an awareness of the discipline’s literacy practices will allow for a more direct initiation into the profession and the ability to provide a clear explanation of particular practices and explanation of the positions that typically perform each task. The clinical internship period that is required for students to complete their training, so they are able to earn certification (ASCP_BOC, 2018b), is the time when pre-professional students begin to move from being peripheral members of the MLS community of practice to novice professionals (Wenger, 1998). The students who have reached the clinical setting are familiar with certain aspects of the Discourse of the profession, which comes from their didactic coursework, but there are disciplinary literacy practices that cannot be adequately presented in a higher education setting, such as the communication that occurs with other healthcare professionals or those associated with healthcare. Even the internal communication that happens between coworkers looks different to students, as they have only exchanged ideas and questions amongst themselves and their instructors. The implicit practices that are part of the profession may not become fully clear to the students during their clinical internships and might only be understood after they have entered the profession and worked for a period of time. Comprehension of the disciplinary literacy practices that have been overtly presented to the students will help them during their training and probationary periods so that they are equipped with these skills rather than learning them on their own.

The training period for new employees, whether novice or seasoned professionals, is also an important time when these disciplinary literacy practices may be tacit. If the practices are not presented in a clear manner, it will cause these professionals to navigate the practices on their own, potentially causing confusion about the proper procedure or delays in patient care. Even an experienced MLS professional must learn the specific practices for an institution where they are a new employee, and if these are not made evident, there is a risk for miscommunication or errors in patient result reporting.

Mentoring new and aspiring professionals into the social interactions, communication methods, and the community of practice (Wenger, 1998) of the profession may also help with recruitment and retention of employees (Butina & Schell, 2011; Kotlarz, 2001; Schill, 2017). Retention has been cited as a vital area for the profession (ASCLS, 2018a) as laboratory education programs are not able to keep up with the current demand (Beck & Doig, 2005; Rothenberg, 2017). This will become a crucial area in the future, as the ongoing shortage of laboratory professionals is only projected to worsen in the next few decades (ASCLS, 2018a; Beck & Doig, 2005; Doig & Beck, 2005; Funnye-Doby, 2016; Rothenberg, 2017). ASCLS does have a formal mentorship program (ASCLS, 2012-2019b), which encourages veteran members to support new professionals within the society. This same concept could be applied to institutions in a formal manner, pairing novice professionals or new employees with previous experience with a seasoned MLS professional who could assist and encourage these employees as they transition to their new work environment. In addition, mentorship could extend to employees that may show interest or potential for advancement in their careers, so that they are encouraged to develop into leaders and

valuable members of the laboratory team. Some may have the potential to progress further up in the laboratory hierarchy.

The recognition and appreciation for the disciplinary literacy practices of the MLS profession can offer a way to make training new employees effective by explicitly teaching the practices. For instance, overtly teaching novice professionals how to write SOPs or conducting a detailed discussion about the best way to communicate with clinical staff, such as physicians and nurses, can better prepare these employees once they are no longer training. These interactions involve the new professional in clear way and can strengthen their sense of belonging in the workplace, encourage them to stay and potentially provide an avenue for advancing their careers in the laboratory.

Disciplinary Literacy Practices in the Educational Setting. MLS educators will benefit from the findings in this study as well. Many of the identified practices are generally part of the MLS curriculum and body of knowledge (ASCLS, 2015), such as the reading practices for evaluation and action as well as visual analysis, where students learn to properly read and interpret patient results and quality control. In particular, students learn to interpret numeric values or other test results that require visual analysis of color changes, growth, agglutination, cell morphology, the graphical output from certain instruments, and others. Students also read instructions during a laboratory experience, which serves as a partial example of an SOP as most laboratory directions do not include the guidelines for reporting patient results to clinicians, nor do they specify how to enter results into the laboratory information system (LIS).

Writing practices in a higher education setting are generally limited to recording results, including those that involve semiotic systems, and certain kinds of

documentation, such as quality control and calibration. While teaching, research, and laboratory management, including scheduling and budgets, are part of the standards required for accredited MLS programs (NAACLS, 2012), an essential understanding about proper sample handling, accurate testing, and precise reporting of the results often takes precedence in the curriculum. However, given that the findings from this study suggest that there are many other writing practices that are important in the MLS profession, such as writing SOPs, policies, or even providing teaching material for both students and other MLS professionals, there are some writing practices that could be incorporated more overtly into the didactic coursework. For instance, as writing SOPs was identified as a disciplinary literacy practice, students could be required to write a SOP using the manufacturer's product insert and, applying guidelines presented in the assignment, include information about reporting results to clinicians and entering them into the LIS. Writing policies was also identified in the study, so students could learn the fundamentals of writing policies, which could detail guidelines for the day-to-day activities of the student laboratory. Examples of accreditation documentation might be incorporated into the curriculum, as this is was identified as a literacy practice in the profession. In addition, teaching students was also highlighted in the findings, so students could develop their own 'continuing education' modules as a way to learn or review a particular unit of content from each other. Teaching the students about these practices explicitly would help to prepare them before they enter the workforce, so that they know how to perform these necessary tasks.

Findings from this study demonstrated the importance of maintaining a continuity of service between the laboratory staff, so that patient care is not interrupted or adversely

affected due to miscommunication. Although student laboratories are not conducted in the same manner as a hospital laboratory, with staffing that works around the clock, writing to maintain a continuity of service could be integrated into the student laboratory assignments. Exercises that span multiple days or involve several steps could require that students follow a classmate after each step in the process. This would mean that every phase of testing would be performed by a different student, but they would have to communicate any issues or errors in writing for the next student so they would know how to interpret the final results. This could also extend to oral communication methods, as well, if time allowed. This would begin the process of apprenticing students into the typical writing or oral communication practices that occur in the hospital setting and between coworkers.

The most challenging practices to incorporate into the educational setting may be the oral communication practices. The types of communication practices experienced in a clinical setting that involve coworkers, clinical staff, those associated with healthcare, and other service providers are difficult to mimic in the didactic setting. Students are typically getting accustomed to performing the procedures themselves, and including these practices could be a distraction. Oral communication associated with teaching or training could be incorporated into the curriculum, and teaching is a requirement for accreditation (NAACLS, 2012). As suggested above, 'continuing education' modules could be prepared and presented by the students so they could learn from one another. More experienced students could also train novice students on how to perform certain tests, so that they can experience the challenges of explaining a method in a way that is clear and understandable to the novice student. Discovering the implicit disciplinary

literacy practices allow them to be made explicit, so that they may be taught directly to pre-professional students. Graduates from these programs will have a more complete understanding of these previously tacit skills, which will prepare the students so they are better able to take on their role as an MLS professional and they will not have to learn about these practices solely through experience.

Research in Disciplinary Literacy

The line of inquiry that examines disciplinary literacy is generally highly theoretical (Z. H. Fang & Coatoam, 2013; Moje, 2007; C. Shanahan & Shanahan, 2014; T. Shanahan & Shanahan, 2012). While there are some studies that examine specific disciplinary literacy practices, such as reading (C. Shanahan et al., 2011) or writing (Carter, 2007), these studies have evaluated the practices and compared them between different disciplines. There are few studies that examine the literacy of one particular discipline (Brill et al., 2007; Frick, 1990), and those that do were not focused on describing the disciplinary literacy practices, but rather sought to provide a broader definition for each of the examined disciplines. Frick's (1990) dissertation identified concepts associated with agricultural literacy for the benefit of educators, but he did not develop a list of specific disciplinary literacy practices. Furthermore, these studies did not investigate a specific profession, but rather research on the examination of broad topics and fields in literacy. Moje (2007, 2008) emphasized the importance of teaching students not only about the content of a discipline, but also the social norms and communication methods for the discipline, such that students would learn the material and also be able to evaluate and communicate in discipline-specific ways. The disciplinary literacy practices identified in this study provide educators, along with those

in the profession, with a clear understanding of the unique practices of the laboratory profession, enabling them to apprentice students and novice professionals into the Discourse and community of practice (Gee, 2015b; Wenger, 1998) that is MLS.

This study represents a first attempt at defining specific disciplinary literacy practices for one particular profession, thus making the implicit practices of the profession explicit. While the Delphi method has been used to define other types of literacy, its use in this study, surveying experts in the profession and asking them to define the discipline's literacy practices, is unique in disciplinary literacy research. Results of the study provided a list of practices that educators and other laboratory professionals can use to apprentice MLS pre-professionals and novice professionals into the field. Although MLS is a highly specific area of healthcare and is taught at the postsecondary level, the methods used in this study could be applied to other disciplines and professions in order to make tacit practices clear for educators at all levels, whether or not they are insiders in the community of practice of a particular discipline. Defining the practices of a discipline offers clear concepts that can be explicitly taught to students, allowing them to more fully understand the Discourse and offering a more complete understanding of the discipline. This study represents a next step in disciplinary literacy research, turning theory in to practice.

Professional Identity of MLS

The professional identity of MLS has long been ambiguous (Evans, 1968; Grant, 2007). Findings from this study demonstrate that little has changed over the years and support the conclusions from previous research, which established that members of the MLS profession feel their work is important, but that the work they do is not well

understood by the general public (Evans, 1968) and is often undervalued by both hospital administrators and others on the healthcare team (Butina & Schell, 2011; Ferraro et al., 2016). Understanding the disciplinary literacy practices of the profession may offer evidence of the valuable role that the laboratory plays in healthcare, contributing to the sociopolitical legitimacy (Benbasat & Zmud, 2003) of the profession. Benbasat and Zmud (2003) define the sociopolitical legitimacy of a discipline as “the acceptance by key stakeholders, the general public, key opinion leaders, and government officials... as appropriate and right” (p.185). The authors go on to state that “if influential stakeholders are unable to comprehend the nature, importance, and distinctiveness of the role being served by the... discipline, these stakeholders are unlikely to acknowledge its legitimacy within the organizational field” (Benbasat & Zmud, 2003, p.185). Sociopolitical legitimacy includes incorporation of cultural values as well as following regulatory guidelines. While the MLS profession is highly regulated and has a moral obligation to accurate patient testing, it is the lack of acceptance or even acknowledgement by the important stakeholders that affects the sociopolitical legitimacy of the profession; the professionals are often behind-the-scenes and the work is not well understood by others in healthcare (Ferraro et al., 2016).

Identified Practices with Opportunities for Professional Identity

Development. There were five disciplinary literacy practices identified by the MLS expert panel that did not reach consensus among the MLS practitioners. However, each of these practices represent areas that would enhance the sociopolitical legitimacy (Benbasat & Zmud, 2003) of the MLS profession. All of the practices had to do with communicating, whether using written or oral communication methods, with various

groups outside of the hospital setting. They include others in healthcare; the general public, including community members, donors, and patients; and legislators. Each of these groups represent the major stakeholders that benefit from the work that the MLS profession performs, whether they are a physician interpreting test results, a patient receiving care, or a legislator looking to cut costs and engage the community.

Recognition from these groups would improve the legitimacy of the profession, which in turn would enhance professional identity. Each area is addressed below.

Improving Professional Identity within the Healthcare Setting. Comments provided in relation to the practice of communicating with patients demonstrated that many in the profession continue to defer to physicians and pathologists (Evans, 1968; Grant, 2007; Kotlarz, 1998a, 1999b, 2000). Several comments limited this practice to just providing instructions on how to collect a specimen correctly, so that the results would be reliable and accurate. While this is an important form of communication, it has also been shown that laboratory professionals have a more complete concept of the types of laboratory tests available at their institution, they can recommend a more reliable test method for a particular disease state, and they can suggest cost-savings and beneficial follow up testing (Ferraro et al., 2016). The value of the information that laboratory professionals can provide to physicians has not yet been fully realized in many places, but education and acceptance by the members of the healthcare team would develop the sociopolitical legitimacy of the MLS profession.

Enhancing the legitimacy of the profession is one area that would help to better define the professional identity of MLS. This may involve more interprofessional interactions among the various members of healthcare, such as allowing the MLS

professional to shadow nurses, physicians, and pharmacists in order to see those aspects of healthcare and understand the role that the laboratory results play for those professionals; offering shadowing opportunities to any member of the healthcare team or even students, whether at the secondary, post-secondary, or even doctoral level; or participating in hospital or pharmacy rounding, where a discussion of patients and their clinical situations take place and the MLS professional can add valuable insights into the laboratory testing. These exchanges would offer opportunities for the laboratory professional to demonstrate their value and knowledge in healthcare.

Several MLS practitioners commented on a lack of support from their employers for attending professional conferences, publishing in professional journals, and presenting continuing education to other MLS professionals or even members of the healthcare team. Given that, beginning in January of 2004, MLS professionals certified by ASCP must complete 36 hours of continuing education every three years to maintain their certification (ASCP_BOC, 2018a), this lack of support for laboratory professionals is telling. While some individuals involve themselves in professional organizations and often pay for their own continuing education, the lack of sponsorship from hospital administrators certainly does not promote the professional identity of MLS. Some professionals also perform research and write articles in professional journals, but this is likely dependent upon the institution where those professionals work and is not supported by all hospital administrators. Often staff shortages, a high workload, and a lack of interest also influence whether or not a laboratorian contributes to the professional discourse. However, a growing professional dialogue among laboratory professionals would serve to enhance the sociopolitical legitimacy and professional identity of MLS.

In pre-professional settings, interprofessional activities among different healthcare-related majors and at different levels of education would offer a way to promote these interactions for the future. Depending on the higher education institution, these majors might include MLS, nursing, respiratory therapy, physician or pathology assistant, pharmacy, and medical students, among others. Early connections with other members of the healthcare team could support recognition and respect amongst these students, such that they are willing to work as a more collaborative team once they become professionals. In addition, encouraging students to participate in research and teaching them how to write professional papers or encouraging them to contribute articles to publications from MLS professional societies would help to enhance this aspect of professional identity.

Improving Professional Identity with the General Public. Although the practice associated with communicating with the general public did not reach consensus, there are important considerations for the laboratory profession. Sharing information with the general public could mean attending public health events or career fairs to promote the profession to members of the public and students who may not be familiar with the variety of healthcare occupations beyond nurses and physicians. Supporting healthcare-focused after school programs would also be an avenue for individuals to learn about the MLS profession. In addition, there have been efforts to communicate with the general public with online resources such as Lab Tests Online (AACCC, 2001-2019), which provide helpful information about laboratory tests, including what the test is for, what the results could mean, and how to prepare for the test. Each of these options not only offer a

method to educate the general public about the laboratory, improving the sociopolitical legitimacy of the profession, but also has the potential to enhance recruitment efforts.

The challenge in this case is that many laboratory professionals chose the MLS profession precisely because it does not generally involve contact with patients or the general public. Many MLS professionals would categorize themselves as introverts and prefer to remain behind-the-scenes. While there are some individuals whose job may be in public outreach or to interact regularly with other members of the healthcare team, it seems clear that more laboratory professionals need to become involved in promoting the profession to others in order to enhance the sociopolitical legitimacy of the profession.

Pre-professional programs might benefit from being able to support students who participate in community outreach events or mentorship programs. Summer camps focused on healthcare would benefit from having pre-professional students working as counselors and they could teach camp attendees about the profession that they have chosen to study. These programs may help with recruitment into the profession, and the counselors, upon graduation, could serve as mentors to pre-professionals once they enter the workforce.

Improving Professional Identity with Legislators. Although professional societies like ASCLS have a political action committee (PAC) (ASCLS, 2012-2019c) that focuses on advocacy for the profession, the effectiveness of the committee requires participation and response from professionals beyond just the committee members. ASCLS, in conjunction with other laboratory-focused associations, participates in a legislative symposium every year (ASCLS, 2012-2019a) where members are able to interact with their representatives and senators in Washington D.C. about issues that

affect the laboratory in a unified and informed way. Recently, the PAC had a call to action in response to a Centers for Medicare and Medicaid Services (CMS) decision to support nurses in being able to perform high-complexity laboratory testing (ASCLS, 2018b; CMS, 2016) and the 2019 legislative symposium is focused on the workforce shortage, which was discussed in a position paper from ASCLS (ASCLS, 2012-2019a, 2018a).

Although members are encouraged to participate, not all laboratory professionals are members of ASCLS. Additionally, interest and motivation to participate are contributing factors; however, it may be that laboratory professionals feel powerless when it comes to legislative decision-making. This would be consistent with the history of MLS professionals deferring to others in healthcare (Evans, 1968; Ferraro et al., 2016; Grant, 2007).

MLS programs can support this type of advocacy by encouraging and assisting students who participate in these events. Alternatively, a student activity group that focuses on government or legislative issues might provide a way for other students to become involved and MLS educators could provide resources and materials to these students to inform their activism.

The matter of MLS deferring to others in healthcare has been a pervasive problem in the profession, and one that has been present since almost the beginning of the profession (Kotlarz, 1998a, 2000). While there have been attempts to separate from the clinical pathologists in the past (Kotlarz, 1999c), a major change in the Discourse of the profession may be necessary to truly address the sociopolitical legitimacy of the MLS profession.

Using Disciplinary Literacy to Promote Professional Identity. Defining the disciplinary literacy practices of the profession offers a new way for laboratory professionals to present their work to outside stakeholders. Acknowledgement by others inside and outside of healthcare could also help with both recruitment among the general public and retention among those professionals who are already a part of the profession. By understanding the work that MLS professionals do, the stakeholders can see the value of the MLS profession. Although five of the disciplinary literacy practices did not reach consensus in the current study, each represents an opportunity for further exploration and enhancement of the sociopolitical legitimacy of the profession by promoting education, advocacy, and participation between laboratory professionals and individuals outside of the laboratory.

Results from this study provide some insights into the types of disciplinary literacy practices that are performed by laboratory professionals at all levels of the laboratory hierarchy. Although it was shown that there can be variability among institutions, the individual's job category, and personal interest, understanding the possible responsibilities can allow MLS professionals to enhance their own job skills and perhaps enhance motivation and satisfaction in their work. If the opportunities are presented during pre-professional programs, novice professionals will be able to enter the workforce with a more complete understanding of the various avenues for achievement and advancement.

Limitations of the Study

As with any research project, there are limitations to this study. While the resources used to reach out to laboratory professionals were quite broad, those

professionals who were not part of my professional network or that were affiliated with ASCLS or the social media sites used could not be included in the sample frame.

Furthermore, the demographic profile of the MLS practitioners who participated showed a lack of racial diversity among the practitioners that does not fully reflect the workforce.

According to the U.S. Department of Health and Human Services (DHHS) National Center for Health Workforce Analysis, between 2011-2015 the racial makeup of laboratory professionals was 9.4% Hispanic, 62% White, 13.7% Black, 11.8% Asian, 0.5% American Indian/Alaska Native, 0.2% Native Hawaiian/Other Pacific Islander, and 2.2% Multiple/Other Race (DHHS, 2017). In this study, there were significantly more white individuals represented (87.1%, see Table 2), while Hispanic, black, and Asian representation was much lower (3.1%, 1.3%, 3.1%, respectively). Individuals that lacked access to the resources used to recruit participants would not have known about the research project, and therefore were not able to participate. This could mean that perspectives held by minority groups were not well represented in these data.

The participants also over-represented females (84.8%, see Table 2) compared to males (12.1%); the DHHS study indicated that laboratory professionals were 73.6% female and 26.4% male (DHHS, 2017). There is a possibility that male MLS professionals' perceptions have not been fully considered in the results of this study.

The attrition over the three rounds of surveys conducted with the MLS expert panel was rather high; however, the MLS practitioner survey was used to help with the trustworthiness of the findings from the experts. Although the number of complete responses for the MLS practitioner survey was more than adequate, there were over 250 responses that were either partially complete or that had been initiated but never

completed. These responses may have offered additional insights that would have provided other, unique practices of the profession not been identified by the MLS expert panel nor those MLS practitioners that did complete the survey. It is possible that all disciplinary literacy practices of MLS have not yet been acknowledged.

Research using surveys also has the potential for researcher bias in the way questions are asked. There is a possibility that the wording of some of the survey questions may have biased the respondents in one way or another. While the cognitive interviews were used to help reduce this bias, it is still a possibility.

Future Research

As this is the first study to examine disciplinary literacy practices in MLS, there are many avenues for future research. Regarding the data obtained from this study, there are many more analyses that can be performed. One example is examining different demographics to determine if there are any significant patterns among the experts and practitioners. For instance, an analysis of whether the geographic location, time in the profession, or degrees or certifications have an effect on the responses provided. In addition, differences in perspectives based on professional title or the type of institution, such as educational institutions, clinical settings, or private or research laboratories could also be explored.

There are several different departments within a laboratory and, especially in larger hospitals, MLS professionals can specialize in one particular area. Because of this, there are opportunities for even more detail related to the particular disciplinary literacy practices within a laboratory department. For example, participants who work exclusively or have specialized in microbiology, chemistry, transfusion medicine, or

hematology might have very unique practices that are specific to one particular area within the laboratory. It would be interesting to understand these department-specific practices in greater detail in order to understand the nuances of the profession. In addition, this could help both professionals and educators when training students and new employees in a particular area.

For MLS educators, incorporation of disciplinary literacy projects into the curriculum could be studied to determine effective teaching methods for conveying these practices to pre-professional students. For instance, students could be given the task of writing a SOP, or a series of SOPs, to reinforce the writing skills associated with this practice. Evaluating the changes in writing skills over the course of a semester or the entire program could be evaluated. Writing research articles or contributions to professional society newsletters may be another way to enhance writing skills, and encourage students to continue contributing to the profession in this manner once they are in the workforce. Explicit teaching of how to write research articles would benefit the students, so that they would have this skill to use in their careers. Students could also hone their oral communication skills through presentations given to other students, whether in their own program or those students studying in a healthcare-associated major. This would provide a foundation for teaching, whether to students, coworkers, or for continuing education. Interprofessional activities may also allow students to teach and communicate with other pre-healthcare students in a less formal setting, opening avenues for improved interaction and understanding across the various healthcare disciplines. These practices were identified by some MLS practitioners who wished they had more

opportunities to contribute in this way, so these are areas of study with potential for further exploration.

A long-term study might involve following a small number of students who contributed research or participated in interprofessional activities to see how these experiences affected their perceptions and careers. Perhaps writing and submitting research or other articles encouraged these professionals to continue with these practices while remaining an active member of a professional society. Participating in interprofessional activities could have the effect of encouraging these professionals to work more closely with others in healthcare to improve communication and understanding between the laboratory staff and others that are part of or support healthcare. The career trajectory of these professionals may be affected such that they have positions that allow them to interact with the public in a way that helps with not only educating about the profession, but also recruitment of new pre-professionals. An examination of the long-term effects of these experiences could provide insights for educators on innovative ways to increase motivation and retention in MLS professionals.

MLS educators may also play a key role in encouraging and supporting current laboratory professionals to share their experiences and innovations with others in the profession by submitting research or review articles to the professions' journals. Unfortunately, this is a challenge, as changes in the culture of healthcare have made it difficult for laboratory professionals to participate in original research (Scott et al., 2015). There is little support from hospital administrators, budgets are often severely limited, workload is often high, and the laboratory has become more focused on serving 'clients' such as the clinicians, nurses, and patients (Scott et al., 2015). An examination of the

perceptions of laboratory professionals, and their desire to participate in research, may provide interesting insights into this area.

There are many avenues for possible methods of enhancing professional identity among laboratory professionals. One major area that deserves some study is understanding why laboratorians continue to defer to physicians and pathologists, even though there is a unique knowledge base among MLS professionals. Survey-based research may provide insights into the perceptions of various laboratory professionals to understand their perceptions of the role of MLS professionals in healthcare.

Understanding the effect of membership in a professional society may also be revealing, as attitudes about the role of the laboratory in healthcare may be different between members and non-members. Additionally, surveys could consider hypothetical scenarios, such as participating in activities such as physician or pharmacy rounding or in-service training for other members of the healthcare team, and how these might enhance professional identity. This could be followed by actual implementation and evaluation of these activities to determine if there are changes in perceptions of the MLS professional identity with surveys before and after the activity. This might offer educators another tool to enhance the curriculum and set a foundation for a more defined professional identity which could help with retention and job satisfaction.

Some challenges in understanding professional identity relate to the fact that there are various 'routes,' that is individuals can enter the profession not only through an accredited MLS program but also with other degrees and approved laboratory experience, as well as different organizations that credential laboratory professionals (AAB, 2018; AMT, 2018; ASCP_BOC, 2018b). This may have an effect on perceptions of

professional identity and certainly add a great deal of variety to the foundational knowledge base for these laboratory professionals. A survey that examines the effects of the various routes to certification on professional identity might offer insights into ways of unifying the profession, thus enhancing the professional identity of MLS.

An examination of the benefits of MLS professionals interacting with younger students, such as STEM-focused middle and high school students, would provide evidence for the education of the general public and possible recruitment opportunities. Studies could examine the changes in perception and knowledge about the MLS profession. These type of studies could incorporate pre-professional students, so that they can take ownership of their own profession and work toward promoting it to the general public. An analysis of the students' feelings of professional identity may help with understanding ways to enhance retention of laboratory professionals.

There are many avenues for further research to enhance both the disciplinary literacy practices of laboratory professionals as well as the MLS professional identity. Gaining a better understanding of these areas will help both educators in preparing students and build a foundation for a more defined and cohesive professional identity.

Conclusion

Although there is more work to be done in order to better understand how to harness the identified disciplinary literacy practices in education and for promotion of the MLS profession, this study represents a beginning. By providing a list of disciplinary literacy practices, new avenues for research and for teaching have been offered. This list has been evaluated and confirmed by MLS professionals throughout the United States and around the world.

Using the perceptions and experience of experts within the MLS profession, the Delphi method (Hasson et al., 2000; Linstone & Turoff, 2002; Maxey & Kezar, 2016) provided a way to define the disciplinary literacy practices of MLS through evaluation and consensus. The addition of the MLS practitioner survey supported the findings from the expert panel, further confirming the results. It is expected that all of the listed disciplinary literacy practices will seem familiar to MLS professionals, as these are the implicit practices that are performed with regularity among practitioners. Making the practices explicit offers educators insight into the habits of mind (Z. H. Fang & Coatoam, 2013) of the profession so they can better prepare pre-professional students. They also give professionals a way to share the unique practices of the profession with others, both inside and outside of healthcare. Defining these practices offers a unique perspective for promoting the profession, enhancing professional identity, and supporting retention and recruitment.

Research into disciplinary literacy is largely theoretical (Z. H. Fang & Coatoam, 2013; Moje, 2007; C. Shanahan & Shanahan, 2014; T. Shanahan & Shanahan, 2012), and there are few studies that have defined the literacy of a particular discipline (Brill et al., 2007; Frick, 1990). However, defining the disciplinary literacy practices for a profession can offer a way for practitioners to better understand their own occupation, and for educators to unambiguously teach the language, communication, and habits of mind (Z. H. Fang & Coatoam, 2013) to pre-professional students. There are many disciplines and professions that have not yet had their disciplinary literacy addressed in the literature and the Delphi method offers one approach for examining these practices. As various disciplines and their literacy practices become known, educators will be able to enhance

the process of apprenticeship into a profession, offering students methods to participate in and critically evaluate each discipline (Moje, 2007). This creates more thoughtful and responsible students and citizens, and provides a deeper understanding of each discipline for the benefit of all.

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APPENDICES

Appendix A – Delphi Project: Round Three Survey**MEDICAL LABORATORY SCIENCE DISCIPLINARY LITERACY STUDY****MLS PRACTITIONER / PROFESSIONAL SURVEY**

Thank you for your participation in both Rounds One and Two for this Delphi project.

This survey represents the third **and final** round of data collection and the questions represent a consolidation of responses that came from both Round One and Round Two.

Please note that your participation for this round is entirely voluntary and you may stop your participation at any time.

Background

In order to understand the focus of this research study, it is important to frame the research in the relevant literature.

Shanahan and Shanahan (2012) state that “disciplinary literacy... is an emphasis on the knowledge and abilities possessed by those who **create, communicate, and use knowledge** within the disciplines” (p.8). Furthermore, each discipline is unique in the way its members understand, use, and share the knowledge of the discipline.

Fang and Coatoam (2013) indicate that “being literate in a discipline means understanding of both disciplinary **content** and disciplinary **habits of mind** (i.e. ways of reading, writing, viewing, speaking, thinking, reasoning, and critiquing)” (p.628). So the concept of disciplinary literacy extends beyond just the content knowledge and considers the ways that experts in a field or profession communicate, how they read and write, and how they analyze information that they are presented with.

Why is this Important?

Understanding the disciplinary literacy of our profession could help educators to better prepare students for the realities of the workplace. Within the didactic coursework, there may be literacy practices that are not being explicitly taught to students that would be helpful for them to know prior to beginning their clinical internships. Defining these literacy practices is the first step in understanding and teaching them to students. Educators could then begin the apprenticeship process, in which students learn these practices and ultimately learn what it means to be an MLS professional. This way, students will be better prepared for the profession.

Defining the disciplinary literacy practices could also help to further define the professional identity of MLS, leading to a more cohesive concept of our discipline similar to other areas of healthcare.

Information About This Survey

There are three primary areas that were addressed in both the Round One and Two surveys and included the reading, writing, and oral communication practices of MLS. Round Two revealed a high level of consensus for many of the identified disciplinary literacy practices that were identified by the expert panel in Round One. There are a few areas that need further clarification, however, and this survey seeks this information.

Survey arrangement:

The first part of this survey seeks to clarify and further understand certain topics and proposed disciplinary literacy practices that did not reach consensus, which was defined as $\geq 75\%$ agreement among expert respondents. Comments provided additional details, which led to the development of clarifying statements related to these practices. These statements have been highlighted in *italicized blue* font.

Following those questions, another section of questions will further refine information related to the role of the MLS and disciplinary literacy practices. These questions did initially reach consensus; however, there were comments that sparked the need to further explore these concepts to better understand what practices are common based on the role of the MLS professional.

In addition to this clarification, some additional practices were identified by experts that will be presented for your evaluation.

Following these sections of clarifying questions, the practices that did reach consensus will again be presented but will measure the level of *perceived importance* of the practice in the profession and the other will measure the *frequency* that each practice is typically performed, in order to gain a deeper understanding about these disciplinary literacy practices.

It is anticipated that this survey should take *no more* than 45 minutes of your time.

There is a **comment box** at the end of each block of questions where you can leave any additional thoughts or ideas you may have at the conclusion of the question set. Feel free to add any practices that you feel are relevant and important, but were not included in these questions.

Once you begin, this survey will be open for two weeks. It is advisable to use the same computer so that you can leave and come back at any time. The survey should bring you back to where you left off. If not, you may have to use the forward and back buttons at the bottom of the survey page to find where you left off. **I hope to collect your responses by Friday, March 1, 2019.**

At the conclusion of the survey, you will be redirected to a second, separate survey where you will provide your name for verification of participation, but your responses will not be connected to your name. Be sure that all of your responses have been recorded prior to being redirected, as you will not be able to go back and make changes after you have submitted the survey.

If you have any concerns about this research, please contact:

Graduate Studies & Research
Holloway Hall 262
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410-677-0047
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If you require clarification related to the questions being asked for any of the rounds of data collection, please contact the principal investigator:

Christina Camillo
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410-236-5657
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DID NOT REACH CONSENSUS (Want to clarify)

NOTE: Each statement grouping presented in a matrix using a 5 point Likert scale

The following topics and proposed disciplinary literacy practices did not reach consensus, which was defined as $\geq 75\%$ agreement among expert respondents. Comments provided by the expert panel revealed additional details, which led to the development of clarifying statements related to these practices. These statements have been highlighted in *italicized blue* font.

Oral communication practices occur between coworkers in the laboratory:

How much do you agree/disagree with the following statements?

- Oral communication practices in MLS relate to **personal conversations** between coworkers that do not relate to work-related topics. *These conversations may be important for team building, but may not be a core disciplinary literacy practice for MLS.*

Oral communication practices occur between the laboratory staff and others associated with healthcare:

How much do you agree/disagree with the following statements?

- Oral communication practices in MLS are associated with **administration of the hospital** including announcements, events, institutional information, etc. *This type of communication is conducted more in writing and not via oral communication.*
- Oral communication practices in MLS are associated with **administration of the hospital** including announcements, events, institutional information, etc. *This type of communication is typically from the top-down and not generally a 'conversation' between laboratory staff and the administration.*
- Oral communication practices in MLS are associated with **administration of the hospital** including announcements, events, institutional information, etc. *Open communication between laboratory staff and the administration depends on the role that the MLS has in the laboratory (e.g. only supervisors and/or managers participate in this type of communication).*
- Oral communication practices in MLS are associated with **environmental services** in the hospital to maintain cleanliness and proper waste disposal. *While an important task for maintaining the hospital laboratory environment, it is not a unique disciplinary literacy practice for MLS professionals.*

Oral communication practices occur between the laboratory staff and others outside of healthcare:

How much do you agree/disagree with the following statements?

- Oral communication practices in MLS are associated with **patients**. May include instructions or explanations. *This is not something that most MLS professionals do consistently. However, in a perfect world – particularly with the advent of online health portals – it would be beneficial for patients to have access to laboratory professionals to understand their test results.*
- Oral communication practices in MLS are associated with **legislators, community members, donors**, etc. *This is not something that most MLS professionals do consistently. These practices are more common for those MLS professionals who are members of professional societies that work on advocacy issues.*
- Oral communication practices in MLS are associated with **legislators, community members, donors**, etc. *This practice depends on the role of the MLS profession (e.g. public outreach coordinator) and is not typical for most MLS professionals.*
- Oral communication practices in MLS are associated with **legislators, community members, donors**, etc. *In an ideal world, it would be beneficial for MLS professionals to become involved in legislative issues and/or to make the profession known to the larger community.*

Do you have any additional thoughts or comments related to the above practices?

[Free Text]

REACHED CONSENSUS
(Want to know more)

NOTE: Each statement grouping presented in a matrix using a 5 point Likert scale.

The following topic related to the role of the MLS and disciplinary literacy practices did reach consensus. However, comments provided by members of the expert panel sparked the need to further explore these concepts to better understand what practices are common based on the role of the MLS professional.

Reading practices and writing practices in MLS are different based on the role of the MLS in the laboratory:

Bench MLS professionals:

Read in a limited and specific way.

Write as it relates to entering patient results and maintaining continuity of service.

Supervisor or management level MLS:

Read in a broader way and read a wider variety of documentation.

Write different and varied items and may include budgets, personnel information, and accreditation documents.

How much do you agree/disagree with the following statements?

- **There is a lot of overlap between the bench and the supervisor.** Supervisors have to be able to read and write the same things as the bench MLS professionals.
- **There is a lot of overlap between the bench and the supervisor.** Many bench MLS professionals are reading and writing the same things that the supervisors must read and write (budgets, schedules, SOPs, instrument evaluations, billing, etc.). This may be because of short staffing issues, or because of their position (e.g. lead MLS) in the laboratory.

Do you have any additional thoughts or comments related to the above practices?

[Free Text]

NEW PRACTICE TO UNDERSTAND

NOTE: Each statement grouping presented in a matrix using a 5 point Likert scale.

The following new disciplinary literacy practices were identified by experts and are being presented for your evaluation.

Writing practices in MLS directed at an audience **inside the clinical workplace** have particular purposes:

How much do you agree/disagree with the following statements?

- The **laboratory information system (LIS)** performs some of the identified writing practices (e.g. autoverification), and therefore these are not part of the typical disciplinary literacy practices of MLS.

Writing practices in MLS that are directed to an audience **outside the clinical workplace** also have particular purposes:

How much do you agree/disagree with the following statements?

- In MLS, writing is done by MLS professionals and educators to **convey information to the general public.**

Do you have any additional thoughts or comments related to the above practices?
 [Free Text]

Oral communication practices occur between the laboratory staff and clinical staff:

How much do you agree/disagree with the following statements?

- Oral communication practices in MLS are done to **convey concerns about patient reports or values**.
- Oral communication practices that **convey concerns about patient reports or values** could be considered part of **conveying information**.
- Many of these oral communication practices, such as **conveying information or asking/answering questions** is **done via written means** (email, etc.)

Oral communication practices occur between the laboratory staff and others associated with healthcare:

How much do you agree/disagree with the following statements?

- Oral communication practices in MLS are associated with **reference and state laboratories**. This communication is necessary for external testing on patient samples that require more complex test methods or for test methods that are not performed at the clinical laboratory.

Oral communication practices can be associated with education:

How much do you agree/disagree with the following statements?

- **Continuing education** and **teaching students** can also be presented **online** (in a written format, or perhaps a recorded presentation) and are not strictly done using oral communication practices.

Do you have any additional thoughts or comments related to the above practices?
 [Free Text]

REACHED CONSENSUS
(Added detail/information being sought)

NOTE: Each statement grouping presented in a matrix using either a 5 or 6 point Likert scale. See each question group for details.

The following questions represent the disciplinary literacy practices that did reach consensus. These are being presented again to measure the level of *perceived importance* of the practice in the profession and the *frequency* that each practice is typically performed. This is being done in order to gain a deeper understanding about these disciplinary literacy practices as part of the MLS profession.

Reading practices in MLS relate to keeping informed:

Please indicate how important you feel these practices are in the daily practice of MLS professionals:

Absolutely essential – Very important – Of average importance – Of little importance – Not important at all

- Reading in MLS is done to **answer a question or solve a problem**, e.g. patient sample testing and results may require use of technical manuals, textbooks, or journal articles.
- Reading in MLS is done to **stay up to date on current issues in medicine, testing, and procedures**, e.g. professional journals, continuing education modules and webinars, conferences, newsletters, or communication provided by administration or supervisors.
- Reading in MLS is done to **learn about and review new technologies, products, or instruments** in order to review the product for purchase or to learn about a new instrument or product that is being introduced into the laboratory setting.
- Reading is done to **prepare or remain knowledgeable in order to teach** students and/or coworkers and others in healthcare.

In an average year, how frequently would you say these practices are used in the MLS profession?

Daily – Weekly – Monthly – Quarterly – Every Six Months – Once a year

- Read to **answer a question or solve a problem**.
- Read to **stay up to date on current issues in medicine, testing, and procedures**.
- Read to **learn about and review new technologies, products, or instruments** in order to review the product for purchase or to learn about a new instrument or product that is being introduced into the laboratory setting.
- Read to **prepare or remain knowledgeable in order to teach** students and/or coworkers and others in healthcare.

Do you have any additional thoughts or comments related to the above practices?

[Free Text]

Reading practices in MLS relate to evaluation and action:

Please indicate how important you feel these practices are in the daily practice of MLS professionals:

Absolutely essential – Very important – Of average importance – Of little importance – Not important at all

- Reading patient results requires **interpretation and analysis of the results**. The MLS professional must determine if results are acceptable and in range, and must make decisions about additional manipulation of the samples (eg. Dilutions)
- Using instruments, kits, or other reagents requires **reading an instrument manual or product insert**. Results produced must be evaluated and interferences or errors are understood by reading the information provided by the manufacturer.
- Reading **standard operating procedures (SOPs)** provides detailed information for performing tests and communicating results to clinical staff. The manufacturer-provided information for an instrument, kit, or reagent are primary resources for these documents.
- **Quality control and calibration results must be read and evaluated** to confirm the test system is working appropriately and providing accurate results for patients.
- When pre-analytical errors occur, when patient results are not consistent, or when instruments present errors, reading is done to **troubleshoot the problem**.
- **Manager or supervisor level MLS will read a variety of documents** that may include **budgets** in order to evaluate current and future spending in the laboratory; **personnel reports**, which may include annual evaluations or disciplinary documents, to evaluate staff performance; and **accreditation and regulatory documents** to evaluate the status of the laboratory and recommend changes, if necessary.

In an average year, how frequently would you say these practices are used in the MLS profession?

Daily – Weekly – Monthly – Quarterly – Every Six Months – Once a year

- Read to **interpret and analyze** patient results.
- Read an **instrument manual** or **product insert**.
- Read **standard operating procedures (SOPs)**.
- Read and **evaluate quality control and calibration results**.
- Read to **troubleshoot** when pre-analytical errors occur, when patient results are not consistent, or when instruments present errors.
- Manager or supervisor (or other MLS) reads **budgets**.

- Manager or supervisor (or other MLS) reads **personnel reports**.
- Manager or supervisor (or other MLS) reads **accreditation and regulatory documents**.

Do you have any additional thoughts or comments related to the above practices?

[Free Text]

Reading practices in MLS include systems that do not require written words (semiotic systems):

Please indicate how important you feel these practices are in the daily practice of MLS professionals:

Absolutely essential – Very important – Of average importance – Of little importance – Not important at all

- Reading in MLS involves understanding **auditory cues**, such as timers, alarms, buzzers, etc.
- Reading in MLS involves interpretation of **numbers and numerical values** in a wide variety of contexts, such as measuring devices, patient results, and budget information.
- Reading in MLS involves visual analysis, which may include **graphical representations**, such as tables, flow charts, diagrams, or data generated by certain instrumentation (e.g. hematology cell scatterplots).
- Reading in MLS involves visual analysis, which may include **images**, such as safety symbols, visualization through a microscope, or images used for comparison or interpretation of results.
- Reading in MLS involves visual analysis, which may include reading patient results that require **interpretation of color changes, agglutination, colony formation and growth patterns on agar, cell morphology, stain results**, etc.
- Visual analysis also includes **interpretation of the results and, if applicable, whether they are correct or incorrect**. For example determining if the stain is correct; if color changes are reliable; if agglutination is appropriate; or if analysis of agar determines growth is normal flora, pathogenic, or contamination.

In an average year, how frequently would you say these practices are used in the MLS profession?

Daily – Weekly – Monthly – Quarterly – Every Six Months – Once a year

- Read and understand **auditory cues**, such as timers, alarms, buzzers, etc.
- Read and interpret **numbers and numerical values**.

- Visually analyze **graphical representations**, such as tables, flow charts, diagrams, or data generated by certain instrumentation (e.g. hematology cell scatterplots).
- Visually analyze **images**, such as safety symbols, visualization through a microscope, or images used for comparison or interpretation of results.
- Read patient results and **interpret color changes, agglutination, colony formation and growth patterns on agar, cell morphology, stain results**, etc.
- Read patient results and **interpret them**, and if applicable, determine whether the results are **correct or incorrect**.

Do you have any additional thoughts or comments related to the above practices?

[Free Text]

Writing practices in MLS directed at an audience **inside the clinical workplace** have particular purposes:

Please indicate how important you feel these practices are in the daily practice of MLS professionals:

Absolutely essential – Very important – Of average importance – Of little importance – Not important at all

- Writing in MLS is done to **maintain a continuity of services**. e.g., communication between all shifts to share information about patients and instruments.
- Writing in MLS is done to **document** a wide variety of things including critical results, quality control and calibration results, instrumentation processes and procedures (instrument logs), and patient sample issues and instrument troubleshooting.
- Writing in MLS is done to **record patient results** and may include additional information that must be shared with the clinical staff including interferences and notifications related to interpretation.
- Writing of **Standard Operating Procedures (SOPs)** is done to provide a step-by-step process for running an instrument or test method.
- Writing **policies** outlines the overall guidelines for the daily processes of the laboratory.
- Writing **orders** enables lab personnel to purchase necessary supplies and equipment.
- Writing in MLS is done to **communicate with and between personnel**, to include email, evaluations, competency assessments, schedules, disciplinary actions, incident reports, and justifications for new products or instrumentation.

In an average year, how frequently would you say these practices are used in the MLS profession?

Daily – Weekly – Monthly – Quarterly – Every Six Months – Once a year

- Write to **maintain a continuity of services**.
- Write to **document** critical results, quality control and calibration results, instrumentation processes and procedures (instrument logs), and patient sample issues and instrument troubleshooting.
- Write to **record patient results** and may include additional information that must be shared with the clinical staff.
- Write **Standard Operating Procedures (SOPs)**.
- Write **policies** to outline the overall guidelines for the daily processes of the laboratory.
- Write **orders** to purchase necessary supplies and equipment.
- Write to **communicate with and between personnel**.

Do you have any additional thoughts or comments related to the above practices?

[Free Text]

Writing practices in MLS that are directed to an audience **outside the clinical workplace** also have particular purposes:

Please indicate how important you feel these practices are in the daily practice of MLS professionals:

Absolutely essential – Very important – Of average importance – Of little importance – Not important at all

- In MLS, professional writing is done for **other professionals** outside of the clinical setting and may include journal articles, editorials, continuing education modules, or case studies.
- In MLS, writing for **accreditation or regulatory bodies** is done to meet the requirements to maintain accreditation and regulation.
- In MLS, writing is done by MLS professionals and educators to **convey information to students**.

In an average year, how frequently would you say these practices are used in the MLS profession?

Daily – Weekly – Monthly – Quarterly – Every Six Months – Once a year

- Write for **other professionals** outside of the clinical setting, including journal articles, editorials, continuing education modules, or case studies.

- Write for **accreditation or regulatory bodies**.
- Write to **convey information to students**.

Do you have any additional thoughts or comments related to the above practices?

[Free Text]

Writing or production practices in MLS relate to **systems that do not use written words** (semiotic systems):

Please indicate how important you feel these practices are in the daily practice of MLS professionals:

Absolutely essential – Very important – Of average importance – Of little importance – Not important at all

- Writing in MLS involves **numbers** associated with patient values and budgets.
- Writing in MLS involves visual representations, such as the production of **diagrams, flow charts, graphs**, etc. to convey information.
- Writing in MLS involves visual representations, such as the production of **images**, including still pictures, animations, videos, etc.

In an average year, how frequently would you say these practices are used in the MLS profession?

Daily – Weekly – Monthly – Quarterly – Every Six Months – Once a year

- Write **numbers** associated with patient values and budgets.
- Produce **diagrams, flow charts, graphs**, etc. to convey information.
- Produce **images**, including still pictures, animations, videos, etc.

Do you have any additional thoughts or comments related to the above practices?

[Free Text]

Oral communication practices occur **between coworkers in the laboratory**:

Please indicate how important you feel these practices are in the daily practice of MLS professionals:

Absolutely essential – Very important – Of average importance – Of little importance – Not important at all

- Oral communication practices in MLS is done to maintain a **continuity of service** so that patient care continues seamlessly between shifts. This includes

communication to keep up to date on current practices and to discuss breaks and covering shifts.

- Oral communication practices in MLS are done to communicate **information about instruments and reagents**, including instrument or reagent status, quality control, calibration, etc.
- Oral communication practices in MLS are for **problem solving**. This includes communication between coworkers related to patient samples, results, or instrument troubleshooting.
- Oral communication practices in MLS are done for **training**. This relates to communication that occurs when training a new employee.
- Oral communication practices in MLS are done **between bench level MLS and supervisors/managers**. Communication happens either from the bench level MLS to the supervisor/manager or the supervisor/manager to the bench level MLS.

In an average year, how frequently would you say these practices are used in the MLS profession?

Daily – Weekly – Monthly – Quarterly – Every Six Months – Once a year

- Communicate to maintain a **continuity of service** so that patient care continues seamlessly between shifts.
- Communicate **information about instruments and reagents**, including instrument or reagent status, quality control, calibration, etc.
- Communicate to **solve a problem**.
- Communicate as part of **training** of a new employee.
- Communicate with either a **bench level MLS or a supervisor/manager** (depending on your position).

Do you have any additional thoughts or comments related to the above practices?

[Free Text]

Oral communication practices occur between the laboratory staff and clinical staff:

Please indicate how important you feel these practices are in the daily practice of MLS professionals:

Absolutely essential – Very important – Of average importance – Of little importance – Not important at all

- Oral communication practices in MLS are done to **convey information**, whether reporting a critical value, blood product availability, or other specifics related to patients and patient care.
- Oral communication practices in MLS are done to **ask or answer questions**. These may be questions coming from the lab to the clinical staff, or from the clinical staff to the laboratory.

In an average year, how frequently would you say these practices are used in the MLS profession?

Daily – Weekly – Monthly – Quarterly – Every Six Months – Once a year

- Oral communication used to **convey information**.
- Oral communication used to **ask or answer questions**.

Do you have any additional thoughts or comments related to the above practices?

[Free Text]

Oral communication practices occur between the laboratory staff and others associated with healthcare:

Please indicate how important you feel these practices are in the daily practice of MLS professionals:

Absolutely essential – Very important – Of average importance – Of little importance – Not important at all

- Oral communication practices in MLS are associated with **instrument maintenance**, both inside and outside of the hospital, including manufacturer service representatives or technicians.
- Oral communication practices in MLS are associated with **other service providers** such as couriers or other delivery personnel.
- Oral communication practices in MLS are associated with **reference and state laboratories**. This communication is necessary for external testing on patient samples that require more complex test methods or for test methods that are not performed at the clinical laboratory.

In an average year, how frequently would you say these practices are used in the MLS profession?

Daily – Weekly – Monthly – Quarterly – Every Six Months – Once a year

- Oral communication related to **instrument maintenance**.
- Oral communication related to **other service providers** such as couriers or other delivery personnel.

- Oral communication related to **reference and state laboratories**.

Do you have any additional thoughts or comments related to the above practices?

[Free Text]

Oral communication practices can be associated with education:

Please indicate how important you feel these practices are in the daily practice of MLS professionals:

Absolutely essential – Very important – Of average importance – Of little importance –
Not important at all

- Oral communication practices related to **continuing education**, including presentations for other MLS professionals.
- Oral communication practices in MLS are related to presentations for **others in healthcare**, who are not MLS professionals.
- Oral communication practices in MLS are related to **teaching students**, whether in the laboratory setting or in a classroom setting.

In an average year, how frequently would you say these practices are used in the MLS profession?

Daily – Weekly – Monthly – Quarterly – Every Six Months – Once a year

- Oral communication related to **continuing education**.
- Oral communication related to presentations for **others in healthcare**.
- Oral communication related to **teaching students**.

Do you have any additional thoughts or comments related to the above practices?

[Free Text]

You will now be redirected to a separate survey to give your name so that your participation may be recorded. If you wish to go back and review your responses, you should do so now, before you move forward.

You will not be able to return to this survey once you have moved forward from here

Thank you!

REDIRECTED:

Please write your name for verification of participation

[Free Text]

Thank you very much for participating in Round Three of this Delphi study!

If you have any questions or concerns, please contact Christina Camillo (cgcamillo@salisbury.edu or 410-236-5657)

Appendix B – MLS Practitioner Survey**MEDICAL LABORATORY SCIENCE DISCIPLINARY LITERACY STUDY****MLS PRACTITIONER SURVEY**

Thank you for your interest and participation in this survey.

Please note that your participation is entirely voluntary and you may stop your participation at any time.

Background and Importance

I am interested in understanding the disciplinary literacy of the Medical Laboratory Science (MLS) profession. That is, I want to know about the unique ways MLS professionals understand, use, and share the knowledge of the discipline. This is not just our content knowledge, but also our "...disciplinary **habits of mind** (i.e. ways of reading, writing, viewing, speaking, thinking, reasoning, and critiquing)" (Fang & Coatoam, 2013, p.628).

Defining these practices could identify concepts that are not being taught and help educators to better prepare students for their clinical internships and subsequently the realities of the workplace. Understanding the practices could also help to further define the professional identity of MLS, leading to a more cohesive concept of our discipline similar to other areas of healthcare.

This data is being collected as part of my dissertation research and may be used in future publications.

Risk/Benefit

- **Participation is entirely voluntary**; you may stop your participation at any time.
- Demographic information requested does not include information that could identify you

- Questions:
 - Are not personal and are not designed to ask you to reveal anything that could be damaging to yourself.
 - Will not ask about patients, therefore little risk of violation of the Health Information Portability and Accountability Act (HIPAA).
 - Focus is on perceptions of the types of reading, writing, and communicating that is typical for MLS professionals
 - There are questions related to the professional identities of MLS professionals
- Benefits
 - You have a chance to share your opinions related to this topic
 - You may learn something new
 - You will be helping to further shape the MLS profession and your professional identity

Confidentiality

The demographic information you provide will be kept confidential on a password protected device. Only the principal investigator and co-principal investigator will have access.

The data collection will be conducted using the Qualtrics software platform. To see the privacy statement from Qualtrics, please visit <https://www.qualtrics.com/privacy-statement/>.

Information About This Survey

- The three primary areas of MLS disciplinary literacy are addressed: Reading, writing, and oral communication practices.
 - These practices were initially defined by a panel of MLS experts.
 - I wish to understand if there is agreement among other MLS Practitioners.
- In addition, there are questions related to professional identity.
 - I wish to understand **your** perceptions of yourself in the profession.
- Questions are presented in blocks.
 - There are several statements associated with each block.
 - You will evaluate the statements using an agree-disagree Likert scale.
- A **comment box** is available after each question block
 - Please leave any additional thoughts or ideas you may have about the questions.
 - Please add any missed practices.

- It is anticipated that this survey should take **no more than 25 minutes** of your time.
- Once you begin, the survey will be open for two weeks.
- It is advisable to use the same computer if you must leave the survey, so that you can return to the question where you left off.
- If you use a different computer, you will have to start the survey from the beginning.

If you have any concerns about this research, please contact:

Graduate Studies & Research
Holloway Hall 262
Salisbury University
Salisbury, MD 21801
410-677-0047
Fax: 410-677-0052

If you require clarification related to the questions being asked or trouble with accessing the survey, please contact the principal investigator:

Christina Camillo
cgcamillo@salisbury.edu
410-236-5657
Office: 410-543-6331

Please indicate whether or not you would like to participate in this research study:

- YES – I would like to participate in this study
- NO – I am unable to participate in this study (redirect to a thank you and close survey)

Demographic Information

In order to better understand the variety of professionals, locations, and situations in the MLS profession, please provide some demographic information.

Please indicate how long you have been a practicing MLS professional:

- 0-5 years
- 5-9 years
- 10-19 years
- 20-29 years
- 30-39 years
- 40+ years

What best represents your highest level of education and credentialing (select all that apply)?

- Associate's Degree
- Bachelor's Degree
- Master's Degree
- Doctoral Degree

- MLT
- MT/MLS
- Categorical credential
- Specialist credential

- (ASCP)
- (AMT)
- (AAB)
- State license

- Other (define below)

If any of the above does not apply to you, please define your education and credentialing.
[Free Text]

Please indicate the type of facility/organization where you work:

- Hospital laboratory (100 beds or less)
- Hospital laboratory (101-250 beds)
- Hospital laboratory (251-500 beds)
- Hospital laboratory (501-750 beds)
- Hospital laboratory (>750 beds)
- Private/Physician's Office Laboratory
- Commercial Medical Reference Laboratory
- Industrial Laboratory

- Research Laboratory
- Veterinary Laboratory
- Consultant
- Instrument Technician or Sales
- Education
- Other (define below)

If the above does not apply to you, please describe your facility/organization.
[Free Text]

Please indicate the region and community type associated with your institution:

- Northeast
- Midwest
- West
- South
- International

- Urban
- Suburban
- Rural
- Military

What is your job title?
[Free Text]

Please indicate your gender

- Male
- Female
- Other
- Prefer not to say

Please indicate your race

- White
- Black or African American
- Hispanic or Latino/a
- American Indian or Alaska Native
- Asian
- Native Hawaiian or Other Pacific Islander
- Other
- Prefer not to say

Did you participate as a member of the MLS Expert Panel for this project?

- Yes
- No

Reading Practices

NOTE: Each statement grouping presented in a matrix using a 5 point Likert scale.

How much do you agree / disagree with the following statements?

Reading practices in MLS relate to keeping informed:

- Reading in MLS is done to **answer a question or solve a problem**, e.g patient sample testing and results may require use of technical manuals, textbooks, or journal articles.
- Reading in MLS is done to **stay up to date on current issues in medicine, testing, and procedures**, e.g. professional journals, continuing education modules and webinars, conferences, newsletters, or communication provided by administration or supervisors.
- Reading in MLS is done to **learn about and review new technologies, products, or instruments** in order to review the product for purchase or to learn about a new instrument or product that is being introduced into the laboratory setting.
- Reading is done to **prepare or remain knowledgeable in order to teach** students and/or coworkers and others in healthcare.

Do you have any additional thoughts or comments related to the above practices?

[Free Text]

How much do you agree / disagree with the following statements?

Reading practices in MLS relate to evaluation and action:

- Reading patient results requires **interpretation and analysis of the results**. The MLS professional must determine if results are acceptable and in range, and must make decisions about additional manipulation of the samples (eg. Dilutions)
- Using instruments, kits, or other reagents requires **reading an instrument manual or product insert**. Results produced must be evaluated and interferences or errors are understood by reading the information provided by the manufacturer.
- Reading **standard operating procedures (SOPs)** provides detailed information for performing tests and communicating results to clinical staff. The manufacturer-provided information for an instrument, kit, or reagent are primary resources for these documents.
- **Quality control and calibration results must be read and evaluated** prior to patient testing to confirm the test system is working appropriately and providing accurate results for patients.

- Reading is done to **troubleshoot the problem** when pre-analytical errors occur, when patient results are not consistent, or when instruments present errors.

Do you have any additional thoughts or comments related to the above practices?

[Free Text]

How much do you agree / disagree with the following statements?

Reading practices in MLS include **systems that do not require written words** (semiotic systems):

- Reading in MLS involves understanding **auditory cues**, such as timers, alarms, buzzers, etc.
- Reading in MLS involves interpretation of **numbers and numerical values** in a wide variety of contexts, such as measuring devices, patient results, and budget information.
- Reading in MLS involves visual analysis, which may include **graphical representations**, such as tables, flow charts, diagrams, or data generated by certain instrumentation (e.g. hematology cell scatterplots).
- Reading in MLS involves visual analysis, which may include **images**, such as safety symbols, visualization through a microscope, or images used for comparison or interpretation of results.
- Reading in MLS involves visual analysis, which may include reading patient results that require **interpretation of color changes, agglutination, colony formation and growth patterns on agar, cell morphology, stain results**, etc.
- Visual analysis also includes **interpretation of whether the results are correct or incorrect**. For example determining if the stain is correct; if color changes are reliable; if agglutination is appropriate; or if analysis of agar determines growth is normal flora, pathogenic, or contamination.

Do you have any additional thoughts or comments related to the above practices?

[Free Text]

Writing Practices

NOTE: Each statement grouping presented in a matrix using a 5 point Likert scale.

How much do you agree / disagree with the following statements?

Writing practices in MLS directed at an audience **inside the clinical workplace** have particular purposes:

- Writing in MLS is done to **maintain a continuity of services**. e.g., communication between all shifts to share information about patients and instruments.
- Writing in MLS is done to **document** a wide variety of things including critical results, quality control and calibration results, instrumentation processes and procedures (instrument logs), and patient sample issues and instrument troubleshooting.
- Writing in MLS is done to **record patient results** and may include additional information that must be shared with the clinical staff including interferences and notifications related to interpretation.
- Writing of **standard operating procedures (SOPs)** is done to provide a step-by-step process for running an instrument or test method.
- Writing **policies** outlines the overall guidelines for the daily processes of the laboratory.
- Writing **orders** enables the lab to purchase necessary supplies and equipment.
- Writing in MLS is done to **communicate with and between personnel**, to include email, evaluations, competency assessments, schedules, disciplinary actions, incident reports, and justifications for new products or instrumentation.

Do you have any additional thoughts or comments related to the above practices?

[Free Text]

How much do you agree / disagree with the following statements?

Writing practices in MLS that are directed to an audience **outside the clinical workplace** also have particular purposes:

- In MLS, professional writing is done for **other professionals** outside of the clinical setting and may include journal articles, editorials, continuing education modules, or case studies.
- In MLS, writing for **accreditation or regulatory bodies** is done to meet the requirements to maintain accreditation and regulation.
- In MLS, writing is done by MLS professionals and educators to **convey information to students**.
- In MLS, writing is done by MLS professionals and educators to **convey information to the general public**.

Do you have any additional thoughts or comments related to the above practices?

[Free Text]

How much do you agree / disagree with the following statements?

Writing or production practices in MLS relate to **systems that do not use written words** (semiotic systems):

- Writing in MLS involves **numbers** associated with patient values, budgets, etc.
- Writing in MLS involves visual representations, such as the production of **diagrams, flow charts, graphs**, etc. to convey information.
- Writing in MLS involves visual representations, such as the production of **images**, including still pictures, animations, videos, etc.

Do you have any additional thoughts or comments related to the above practices?

[Free Text]

Oral Communication Practices

NOTE: Each statement grouping presented in a matrix using a 5 point Likert scale.

How much do you agree / disagree with the following statements?

Oral communication practices occur **between coworkers in the laboratory**:

- Oral communication practices in MLS is done to maintain a **continuity of service** so that patient care continues seamlessly between shifts. This includes communication to keep up to date on current practices and to discuss breaks and covering shifts.
- Oral communication practices in MLS are done to communicate **information about instruments and reagents**, including instrument or reagent status, quality control, calibration, etc.
- Oral communication practices in MLS are for **problem solving**. This includes communication between coworkers related to patient samples, results, or instrument troubleshooting.
- Oral communication practices in MLS are done for **training**. This relates to communication that occurs when training a new employee.
- Oral communication practices in MLS are done **between bench level MLS and supervisors / managers**. Communication happens either from the bench level MLS to the supervisor / manager or the supervisor / manager to the bench level MLS.

Do you have any additional thoughts or comments related to the above practices?
[Free Text]

How much do you agree / disagree with the following statements?

Oral communication practices occur between the laboratory staff and clinical staff:

- Oral communication practices in MLS are done to **convey information**, whether reporting a critical value, blood product availability, concerns about patient reports or values, or other specifics related to patients and patient care.
- Oral communication practices in MLS are done to **ask or answer questions**. These may be questions coming from the laboratory staff to the clinical staff, or from the clinical staff to the laboratory staff.

Do you have any additional thoughts or comments related to the above practices?
[Free Text]

How much do you agree / disagree with the following statements?

Oral communication practices occur between the laboratory staff and others associated with healthcare:

- Oral communication practices in MLS are associated with **instrument maintenance**, both inside and outside of the hospital, including manufacturer service representatives or technicians.
- Oral communication practices in MLS are associated with **other service providers** such as couriers or other delivery personnel.
- Oral communication practices in MLS are associated with **reference and state laboratories**. This communication is necessary for external testing on patient samples that require more complex test methods or for test methods that are not performed at the clinical laboratory.

Do you have any additional thoughts or comments related to the above practices?
[Free Text]

How much do you agree / disagree with the following statements?

Oral communication practices occur between the laboratory staff and others outside of healthcare:

- Oral communication practices in MLS may be associated with **patients**. May include instructions or explanations.
Though this is not something that most MLS professionals do consistently, with the advent of online health portals it would be beneficial for patients to have access to laboratory professionals to understand their test results.
- Oral communication practices in MLS can be associated with **legislators, community members, donors**, etc.
Though this is not something that most MLS professionals do consistently, they can be associated with MLS professionals who are members of professional societies that work on advocacy issues.
- Oral communication practices in MLS can be associated with **legislators, community members, donors**, etc.
In an ideal world, it would be beneficial for MLS professionals to become involved in legislative issues and/or to make the profession known to the larger community.

Do you have any additional thoughts or comments related to the above practices?
[Free Text]

How much do you agree / disagree with the following statements?

Oral communication practices can be associated with education:

- Oral communication practices in MLS are related to **continuing education**, including presentations for other MLS professionals.
- Oral communication practices in MLS are related to presentations for **others in healthcare**, who are not MLS professionals.
- Oral communication practices in MLS are related to **teaching students**, whether in the laboratory setting or in a classroom setting.
- **Continuing education** and **teaching students** can also be presented **online** (often using both a written format and a recorded presentation) and are not strictly done using oral communication practices.

Do you have any additional thoughts or comments related to the above practices?
[Free Text]

Professional Identity

NOTE: Each statement grouping presented in a matrix using a 5 point Likert scale, unless otherwise noted.

How much do you agree / disagree with the following statements?

Reading and writing practices in MLS are different based on the role of the MLS in the laboratory:

- **‘Bench’ MLS professionals** read and write in limited and specific ways. e.g. reading and writing test results, SOPs, and information to maintain a continuity of service, etc.
- **Supervisor or management level MLS** read and write in a broader way. e.g. reading and writing a wider variety of documentation, such as budgets, schedules, personnel evaluations, orders, accreditation documentation, etc.
- **There is a lot of overlap between the supervisor and the ‘bench’.** Supervisors have to be able to read and write the same things as the ‘bench’ MLS professionals.
- **There is a lot of overlap between the ‘bench’ and the supervisor.** Many ‘bench’ MLS professionals are reading and writing the same things that the supervisors must read and write (budgets, schedules, SOPs, instrument evaluations, billing, etc.). This may be because of short staffing issues, or because of their position (e.g. lead MLS) in the laboratory.

In **my role** at my institution, I [*Multiple options*]

- Read and write in a limited and specific way, consistent with a ‘bench’ MLS professional
- Read and write a wide variety of items or documents consistent with a supervisor or manager
- Read and write in a way that is beyond my official position

Do you have any additional thoughts or comments related to the above practices?

[*Free Text*]

How much do you agree / disagree with the following statements?

Oral Communication practices in MLS are different based on the role of the MLS in the laboratory:

- Oral communication practices in MLS that are associated with **administration of the hospital** (e.g. announcements, events, institutional information, etc.) depends on the role that the MLS has in the laboratory (e.g. only supervisors and/or managers may participate in this type of communication).
- Oral communication practices in MLS that may be associated with **legislators, community members, donors**, etc. depends on the role of the MLS profession (e.g. public outreach coordinator) and is not typical for most MLS professionals.

In **my role** at my institution, I [*Multiple options*]

- Communicate regularly with the administration of the hospital
- Communicate regularly with legislators, community members, donors, etc.
- Do not communicate with either the administration of the hospital or legislators, community members, donors, etc.

Do you have any additional thoughts or comments related to the above practices?

[*Free Text*]

How much do you agree / disagree with the following statements?

Related to **my own identity** as a MLS professional:

- I believe I am an important member of the healthcare team
- I am an active member of a professional organization or association (beyond credentialing)
- I am given opportunities for continuing professional development at my institution
- I stay up to date on the current legislation and regulations that apply to the clinical laboratory
- I attend professional meetings / conferences / workshops on a regular basis
- I am given the opportunity to teach other laboratory professionals, other healthcare professionals, or pre-professional students
- I interact well with other members of the healthcare team
- I read professional journals on a regular basis
- I am treated as a professional in my institution
- I have a good relationship with the other members of the healthcare team
- I am respected in my institution
- I am proud of the work I do as a member of this profession
- I believe I have a responsibility to promote the MLS profession to others
- I believe the general public is familiar with my profession and the role we play in healthcare

Do you have any additional thoughts or comments related to the above practices?

[*Free Text*]