ABSTRACT

HORSTMAN, SARAH COBLE. Mathematics Professional Development for Community College Faculty: Research Synthesis. (Under the direction of Dr. Paola Sztajn).

This study examined the design of professional development for community college mathematics instructors. The study comprised of a research synthesis: manuscripts focused on professional development for community college mathematics instructors were collected, pre-screened, screened, and features of their design were coded and analyzed. Recommendations and suggestions from the professional development literature were translated into the set of variables defined in the codebook. There were 14 manuscripts coded in this research synthesis. The results of the study were descriptive in nature. They indicated that pedagogical content knowledge was the most frequent goal for mathematics professional development for community college instructors. Adult numeracy was the most frequent mathematics content utilized in these professional developments. Additionally, it was found the professional developments were focused on community college mathematics or adult numeracy instructors with other stakeholders also in attendance. Results indicated that many important details of the design of the professional development opportunities for mathematics instructors in community colleges are not reported in published manuscripts.
Mathematics Professional Development for Community College Faculty: Research Synthesis

by
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A thesis submitted to the Graduate Faculty of North Carolina State University in partial fulfillment of the requirements for the degree of Master of Science in Mathematics Education

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DEDICATION

This thesis is dedicated to the improvement of continuing education and professional development for community college mathematics faculty. It is the intent of this writing to provide insight into the world of professional development for adult educators, specifically within the community college system.
BIOGRAPHY

Sarah Coble Horstman was born in Linwood, North Carolina on November 28, 1987. She is the daughter of Paul and Clair Wylie and younger sister to Carrie Schmiesing. She grew up in a small rural community on the family’s working dairy farm, home to prized, registered Guernsey cows. Sarah learned many life-long lessons through her work on the farm, including the value of hard work, commitment, and perseverance. Through the family farm and exhibiting dairy cattle at many regional, state, and national shows, Sarah learned the value of educating others. Her love for teaching blossomed at a young age through these experiences.

Sarah graduated from Central Davidson High School and began her undergraduate career at North Carolina State University in 2006. During her first years at NCSU she discovered her passion for mathematics. This newfound interest, combined with her love of education and desire to learn, made a degree in Mathematics Education the right choice for her. In December 2010 she graduated Magna Cum Laude with a Bachelors Degree in Mathematics Education with a concentration in Secondary Education.

Sarah witnessed the impact her mother had on her students as a community college instructor while developing a greater understanding about the students in the community college. These students are faced with real-life circumstances each day and make significant sacrifices in hopes of a better life for themselves and their families through their commitment to education. This early influence precipitated Sarah’s
desire to teach mathematics in the Community College system. In January of 2011 she began her pursuit of a Master of Science degree in Mathematics Education from North Carolina State University. At the conclusion of her Master’s Degree, Sarah plans to pursue a career in mathematics education within a North Carolina Community College.
ACKNOWLEDGMENTS

As many aspects of teaching well are founded on hard work, dedication and perseverance of a multitude of individuals, so is this thesis. It is intended that this acknowledgement section provide a token of appreciation and gratitude to those who have helped me along this journey.

Foremost, I am grateful and appreciative to my advisor Dr. Paola Sztajn for being a wonderful advisor, as well as committee chair, mentor, and teacher. I am especially grateful for her insight in the development of this thesis, which has allowed it to become what it is today. Her academic and personal support has helped me develop as a professional with a deep passion for mathematics education. I would also like to extend my gratitude to the work completed by Dr. Paola Sztajn and Kwang Suk Yoon, research synthesis of empirical studies in P-12 Mathematics Education, where much of my codebook and structure for my research synthesis began.

My deepest appreciation is also extended to the members of my committee, Dr. Allison McCulloch and Dr. Kimberly Weems. They provided guidance for this thesis and for my graduate degree. Dr. McCulloch, thank you for all of the guidance through my undergraduate education as well as my master’s degree. Dr. Weems, thank you for opening my eyes to the wonderful world of statistics. Your influence has played an important role in my graduate education.

I would like to extend my thanks to my wonderful husband, Marc. Thank you for supporting, encouraging, and motivating me through this process. You are my better
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Lastly, many thanks go to the National Science Foundation for funding this Master’s Study and Thesis. The work on this study was supported through a grant from the National Science Foundation (DRL#1019934). Opinions and findings expressed in this report are those of the author and do not necessarily reflect the views of the National Science Foundation.
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CHAPTER 1: INTRODUCTION

Many researchers agree one of the main contributors to increased instructor performance is effective professional development in their field. Darling-Hammond, Wei, Andress, Richardson, and Orphanos (2009) stated, “that well designed professional development can influence teacher practice and student performance” (p. 9). The need for professional development for instructors exists at all levels in education, from P-16 and even beyond.

This study focuses on professional development for community college instructors. For the purpose of this thesis, community colleges are defined as any institution which is regionally accredited to award the associate in arts or the associate in science as its highest degree (Brawer & Cohen, 2008; Vaughan, 1995).

Growing up in a rural and industrial based area, I saw the effects of factory jobs moving away from the area. During that time, there were many adults who needed to learn new skills in order to obtain employment. This need resulted in an increase in the adult population seeking education. This sparked my interest in post-secondary education, particularly at the community college level. During my undergraduate studies as a mathematics education major at NCSU, the importance of effective professional development for teachers was stressed. This made me wonder if similar emphases were true for community college faculty and if similar approaches to professional development were helpful for community college faculty. Thus, the focus
of my thesis is based on my interest in both community colleges and in professional development.

Professional development for community college faculty is becoming increasingly important as more adults choose to further their education through this venue. In 2005, community college faculty were teaching approximately “37% of all undergraduates and about half of all freshmen and sophomore” post-secondary students in the United States (Twombly & Townsend, 2008, p. 5). Also, at that time, “43% of all full and part time faculty members in public, nonprofit higher education institutions were in public community colleges” (p. 5). Community college faculty not only teach students who earn degrees from community colleges, but they also teach students who begin their education at the community college and then transfer to a four year college as well as students who are still enrolled in high school or are returning to school for additional coursework (Twombly & Townsend, 2008). These percentages illustrate the importance of community college faculty members being effective teachers; they represent a large teaching force and teach a high percentage of higher education students, particularly in the early years of college-level work.

The North Carolina Community College System (2006) reported that during the 2005-2006 academic year the number of full time faculty in Community Colleges in the state increased to 6,053. Also during this same academic year the percent of part time faculty also increase by 58% (North Carolina Community College System, 2006). In 2012 of the 6,909 faculty members in the North Carolina Community College system
3,932 had Master’s degrees and 508 had Doctor’s Degrees as their highest degree earned (North Carolina Community College System, 2012). These highest degrees earned are what qualifies faculty to teach at North Carolina Community Colleges. These degrees need only to be in the field the faculty are teaching in. Therefore, no formal teacher training is required of these faculty members.

Twombly and Townsend (2008) illustrated the importance of investigating the professional development in which community college faculty were involved. They composed a review of the literature about community college faculty and stated that professional development is of utmost importance for these faculty members so they are able to remain current in their field. They speculated about why community college faculty have received so little scholarly attention and acknowledged the limited amount of research available that focused on community college instructors. Twombly and Townsend (2008) reasoned this was mostly likely due to “the tremendous variation among institutions in terms of size, population served, and geographic location” (p. 11). They also noted that while professional development for community college faculty has been reviewed, the literature typically lists what community colleges have done as opposed to what makes professional development effective for community college faculty.

Brawer (1990) found, from research conducted with community college faculty, that an increased push for more professional development started in the 1960’s. Further, in more recent years, professional development for community college faculty
has generally become more focused on faculty development (Brawer, 1990). Faculty
development occurs when community college faculty are provided activities which
“promote the expertise of faculty members within their primary discipline” (p. 51),
“improves faculty's ability to teach more effectively” (p. 52), “is aimed at evaluating or
revising the curriculum” (p. 52), or “engages faculty members in improving their
institute and its environment for teaching and decision-making” (p. 52).

While a push for more professional development is a move in the right direction
for community college faculty, more information is needed to determine what would be
most beneficial to these faculty members. Thus, stemming from the findings and
suggestions discussed, the goal of this thesis is to review what is reported about
professional development that has been implemented for mathematics instructors at
the community college level in the past ten years. More specifically, in this study, I
address the following overall research question: What does the literature report
regarding the design of mathematics professional development at the community college
level?

A synthesis research approach was utilized to provide a description of reported
professional development interventions for community college mathematics faculty
over the past 10 years. A research synthesis provides a summarization of past research
and recommendations for community college mathematics professional development.
According to Cooper (1998) a “research synthesis focuses on empirical studies and
seeks to summarize past research by drawing overall conclusions from many separate
investigations” (p. 3). Cooper recommended five stages for synthesis research, which were adapted and followed in this descriptive synthesis. The recommended stages are as follows:

a. Problem Formulation
b. Data Collection
c. Data Evaluation
d. Analysis and Interpretation
e. Public Presentation

For this thesis, the problem formulation stage aligns with the literature review and the refinement of the research question. These sections were utilized in analyzing the literature focused on community college professional development for mathematics faculty. The data collection and data evaluation phases align with the methodology of this study. The analysis and interpretation phase aligns with the results section of the thesis. Finally, as a whole, the writing of this thesis represents a form of public presentation of the research. Thus, based on Cooper’s (1998) recommendations for organization of a synthesis study, this thesis was broken down as follows: Chapter 2: Literature Review, Chapter 3: Methodology, Chapter 4: Results, Chapter 5: Discussion.
CHAPTER 2: LITERATURE REVIEW

2.1 Review of Literature

2.1.1 History of Community Colleges

Community colleges emerged in the United States during the beginning of the 20th century (Phillippe & Patton, 1999). However, Vaughan (1995) traced the philosophical start of community colleges to the Morrill Act of 1862, which allowed the addition of courses and student populations previously excluded to public high education. This expansion of education continued throughout the 1920’s, 1940’s, 1950’s and 1960’s (Brawer & Cohen, 2008; Phillippe & Patton, 1999; Vaughan, 1995). This occurred through the return of World War II veterans, the national call for open and equitable education for everyone, and the demands of political and social action in the 1950’s and 1960’s (Phillippe & Patton, 1999; Vaughan, 1995). Community colleges, or junior college as they were originally named, have grown from Joliet Junior College, the first in the United States in 1901, to more than 1,655 community colleges across the USA in 2001 (Phillippe & Patton, 2000; U.S. Department of Education, 2005; Vaughan, 1995).

Community colleges additionally provide a diverse set of courses, which focus on the needs of the community they serve; therefore, no two community colleges are the exact same. Courses offered by each institution can be anything from occupational, developmental, college-transfer, or life-long education courses. Each community college is loosely linked to all of the other community colleges in the nation through
their shared goal of access and service (Phillippe & Patton, 2000). At least 5.6 million people and more than half the national undergraduates have attended community colleges since the origination of the community college (Brawer & Cohen, 2008; Phillippe & Patton, 2000; U.S. Department of Education, 2005). The community college’s focus on the needs of the community it serves ensures it changes with the community it supports. This has provided for the growth of community colleges in the past century and has helped community colleges thrive through that time period (Phillippe & Patton, 2000).

North Carolina’s Community College System has grown from its start in 1963 with six community colleges, to the 58th community college being established in 1979 (North Carolina Community College System, 2008). In particular North Carolina has ensured its community colleges are focused on community needs by making higher education no more than a 30-minute commute for all of the colleges’ communities (Phillippe & Patton, 2000). In 2008, there were 6,377 faculty providing instruction to 273,015 students enrolled in curriculum courses, developmental courses, distance education courses, and/or continuing education courses across the state of North Carolina (North Carolina Community College System, 2008). Although, the North Carolina Community College System is no longer growing by number of campuses, the community college system is constantly evolving to meet the needs of the communities they serve.
The United States community college system’s rich history exhibits the progressive nature of the system. Since so many students attend a community college at some point during their educational career, it is necessary to take a closer look at what is being provided to their instructors, in terms of professional development.

2.1.2 Purpose of the Literature Review

This review of the literature is being completed to inform the problem formulation phase of this thesis. The goal of the review is to determine important recommendations established in the literature for professional development of mathematics faculty in the community college setting. These recommendations are then used to refine my research question and later examine the existing descriptions presented in published paper about professional development programs for community college mathematics faculty.

The manuscripts chosen for this literature review were selected based upon their focus on professional development for community college faculty. Along with manuscripts focused on community college professional development, two manuscripts focused on general recommendations for K-12 professional development were also reviewed. The American Institutes for Research (2007) recommended specific suggestions for the structure and implementation of professional development for community college faculty could be based on findings from the K-12 research literature. However, they noted “the vast differences between the characteristics of teachers, the teaching environment, and the professional development opportunities in K-12” and
those in community college education needed to be acknowledged (p. 49). These suggestions were made for professional development in general, and it is reasonable to apply them to mathematics professional development. Similarly to applying K-12 research to community colleges, some states have taken comparable approaches when refining their goals for professional development for community colleges. Regarding community college goals for mathematics in particular, several states have utilized National Council of Teachers of Mathematics (2000) Principles and Standards for School Mathematics recommendations to refocus their content standards for adult education, indicating the need for community college faculty to also be knowledgeable about K-12 mathematics content topics (American Institute for Research, 2007).

In this study, the recommendations from community college and K-12 professional development were utilized to assist in refining and answering the research question of this thesis. In what follows, these recommendations are presented and discussed. Commonalities between the two settings’ recommendations were summarized and combined into a list of 10 recommendations for mathematics professional development for community college instructors.

2.1.3 Review of Recommendations for Mathematics Professional Development for Community College Faculty

The American Institute for Research (2007) noted there is little research on professional development for community college faculty, although the researchers acknowledged some small-scale studies have been conducted. In recent years, the
professional development being offered to community college faculty, for the most part, has aimed at “improving instruction and increasing knowledge” and was dependent upon the colleges’ “vision of desired ends” (Brawer, 1990, p. 51). For example, Brawer (1990) found that since the 1960's community college faculty development has been focused on instructional development, primarily. In this study instructional development was defined as activities which “improve the faculty’s ability to teach more effectively” (p. 51). Even though professional development for college faculty has increased since the 1960's, it peaked during the 1970's (Brawer, 1990). Brawer considered this lower priority of professional development in community colleges as a concern that should be addressed.

While there is minimal research on community college professional development in general, there appears to be even less research on professional development for community college mathematics instructors. The following literature on professional development for adult education is reviewed for the purpose of this review: American Institutes for Research (2007), Brawer (1990), and Kutner and Tibbetts (1997). These three articles were selected for this review because they provided recommendations for professional development focused on community college mathematics faculty. These manuscripts indicated suggestions for implementing effective professional development for mathematics instructors in the community college setting that are discussed in what follows.
In general, The American Institutes for Research (2007) recommended professional development for mathematics instructors should “help teachers ‘unpack’ mathematics by motivating teachers and helping them increase their knowledge of innovative ways to promote mathematics to a diverse body of students” (p. 51). This implies professional development should help instructors learn more about the mathematics content they are teaching as well as new and interesting ways to present the material to students. The review of professional development in adult numeracy by American Institutes for Research (2007) also found five main features of quality professional development: duration, content knowledge, active learning, collective participation, and coherence (p. 54). The American Institute for Research (2007) described the features in the following ways.

- **Duration**: the professional development should be “sustained over time (including the total number of contact hours and the span over which the activity takes place)” (p. 54).
- **Content knowledge**: the professional development focused “both on content in the subject area” and broadening instructors knowledge of how students learn the content (p. 54).
- **Active learning**: instructors should be allowed the opportunities to observe other instructors as well as reviewing and discussing student work, through either verbal or written means (p. 54).
• Collective participation: participation of instructors in the professional development should be from the same department or content area (p. 54).

• Coherence: the professional development should be aligned with instructors, schools, departments, and state’s goals (p. 54).

It is important to note these specific suggestions were generalized to community college faculty from research conducted with K-12 teachers. The American Institute for Research claimed this generalization could be done for community college mathematics faculty professional development based on the similarities of the content standards they teach as well as similarity between the needs of the K-12 teachers and mathematics faculty in community colleges (p. 52).

Brawer (1990) provided a general review of literature pertaining to faculty development at community colleges. As noted previously, the community colleges began focusing on faculty development during the 1970’s where they were focused primarily on instructional development. However, even with this increased focus on professional development, “faculty development has not become a high priority in community colleges. Most districts allocate some funds to these activities, but they are often sporadic and uncoordinated” (p. 51). For those that provide professional development it should be a purposeful learning experience for faculty. These experiences should increase faculty understanding of content and improve instruction provided by the faculty.
Kutner and Tibbetts (1997) provided their ideas for components of a professional development system for adult educators. They made suggestions for the providers of the professional development, the support behind it, and the types of programs and activities that could be provided. In general their overall suggestions were for “an intergovernmental infrastructure supporting professional development, the availability and delivery of multiple professional development activities and approaches, and ongoing evaluation activities that are integral components of professional development services” (p. 1). Their main suggestion for professional development of community college faculty was for multiple approaches and options to be provided to faculty in order to address the ever-changing nature of the colleges and the content for which faculty are responsible. Also, the content provided to faculty in these settings should reflect the skills and knowledge base necessary for adult education as well as the needs of the faculty. Recommended activities and approaches for professional development for community college faculty are as listed: workshop/presentation to gain new skills and knowledge, observation/feedback from other faculty members, inquiry/research on their own teaching, and product/program development for items such as curriculum or program redesign.

2.1.4 Review of Literature on K-12 Professional Development and Recommendations

In order to bridge between community colleges and K-12, synthesis studies from K-12 research were examined to determine what makes an effective professional
development for K-12 teachers. The following were studies examined for the purpose of this review of the literature: Darling-Hammond, Wei, Andree, Richardson, and Orphanos (2009), Guskey and Yoon (2009), and Yoon, Duncan, Lee, Scarloss, and Shapley (2007). These studies were chosen because they were research synthesis manuscripts that provided a comprehensive overview of the K-12 recommendations for professional development. Looking across the three professional development syntheses reviewed at the K-12 level the following features of professional development were suggested. Professional development should be:

1. Sustained over time
2. Focused on content
3. Aligned with school, district and state standards and goals

Specifically, Darling-Hammond et al. (2009) investigated a pool of quantitative studies and reported the characteristics effective professional development should possess for the improvement “of teachers’ practice and student learning” (p. 5). Also discussed in this manuscript were trends and strategies being utilized in professional development abroad. This manuscript then compared these findings to professional development occurring in the USA. Overall, Darling-Hammond et al. (2009)’s key findings laid out what the research has found to be important aspects of effective professional development for K-12 teachers. The findings were as follows: professional development should be: sustained, intensive, ongoing, connected to practice, focused on content, build relationships, and connected to school initiatives, collaborative
approaches can promote school change, significant variation occurs among schools and states, and many short term conferences were utilized.

Guskey and Yoon (2009) presented a research synthesis that determined the relationships between student improvement and professional development of the students’ teachers. Their research synthesis reviewed nine investigations to determine if the professional development shared common characteristics or elements. The common elements, which emerged from the synthesis, are their recommendations to follow when designing and implementing effective professional development for K-12 teachers. These recommendations are that professional development should include sustained and structured follow-up, provide activities to instructors that are linked to improvement of student learning, and focus on enhancement of content knowledge and pedagogical content knowledge.

Yoon et al. (2007) also conducted a review that resulted in the analysis of nine studies focused on professional development for K-12 teachers in order to answer the following question: “How does teacher professional development affect student achievement?” (p. iii). The analysis of these nine studies revealed suggestions for how professional development should be organized in order to positively affect student achievement. Yoon et al. (2007)’s review concluded that K-12 professional development can be “characterized by coherence, active learning, sufficient duration, collective participation, a focus on content knowledge, and a reform rather than traditional approach” (p. 1).
2.1.5 Commonalities between K-12 and Community College Recommendations

There are many similarities between the recommendations for professional development provided in the community college literature and in the K-12 literature. Generally, these reviews suggested professional development should occur over an extended period of time, be intensive, connected to content and practice, focused on content and practice, aligned with school and/or state standards or goals, focused on increased knowledge and skills for either the instructor or the students, and should build working relationships between faculty (American Institutes for Research, 2007; Darling-Hammond et al., 2009; Guskey & Yoon, 2009; Yoon et al., 2007). Guskey and Yoon (2009) also emphasize the importance of “significant amounts of structured and sustained follow-up after the main professional development activities” (p. 497). Both the K-12 and community college recommendations include utilizing an array of activities and forms of presentation during professional development sessions (Darling-Hammond et al., 2009; Kutner & Tibbetts, 1997). Through selection of activities and formats for professional development, instructors are able to choose the option which works best for their area of interest for content knowledge and pedagogical knowledge as well as the instructors’ learning style. An important reminder was provided by Kutner and Tibbetts (1997) that professional development requires the support and involvement of stakeholders from the college, community, and state levels as well as from the providers of the professional development and therefore should include these stakeholders and program administrators when feasible. Finally, even though the
structure and content are most likely decided at the state level, it is important for the needs of the instructional staff at the institution to be taken into account during the design and implementation of the professional development (Kutner & Tibbetts, 1997).

2.1.6 Recommendations for Professional Development

In summary the following suggestions have been made in the current literature for professional development for faculty. Professional development should:

1. Focus on mathematics content knowledge for instructors
2. Focus on pedagogical knowledge for instructors
3. Focus on active learning for instructors
4. Focus on interaction between instructors to build relationships
5. Be sustained over time
6. Allow for collective participation
7. Be coherent with institutional goals
8. Have structured and sustained follow-up
9. Be provided in multiple forms of presentation
10. Include stakeholders

This list of suggestions was created through a combination of literature reviewed from both community college professional development and K-12 professional development. Through the recommendation of the literature and for the purpose of this thesis, I utilized this list as recommendations for professional development for community college mathematics faculty. They were used in the development of the codebook that
was utilized to evaluate professional development manuscripts, collected based on their focus of professional development for community college mathematics faculty.

2.2 Refining the Research Question

The overall goal of this thesis is to analyze the descriptions of professional development experiences provided to community college mathematics faculty present in the research literature of the past 10 years. To help achieve this goal, a research synthesis on manuscripts focused on community college mathematics professional development has been completed. The recommendations from the literature review were utilized to further develop the overall research question into four, more focused, research questions, which will assist in identifying the specifics of professional development opportunities being provided.

The overarching research question for this study is: *What does the literature report regarding the design of mathematics professional development at the community college level?* Based on the review of the literature, this question was separated into the following four specific research questions to be investigated.

1. Are features of effective professional development that are recommended for K-12 teachers present in professional development for community college mathematics faculty?

2. Who are the participants in the professional development opportunities offered to community college mathematics faculty?
3. What is the mathematics covered in the professional development opportunities offered to community college mathematics faculty?

4. What are the goals of the professional development opportunities offered to community college mathematics faculty?

Figure 1 shows how each of these questions relate to the various recommendations for professional development that were found in reviewing the literature on recommendations for effective professional development.
<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Recommendations from the Literature Review</th>
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<tbody>
<tr>
<td>1. Are features of professional development that are recommended for K-12 teachers present in professional development for community college mathematics faculty?</td>
<td>• Focus on active learning for instructors</td>
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<td>• Be sustained over time</td>
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<td>• Allow for collective participation</td>
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<td>• Be provided in multiple forms of presentation</td>
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<tr>
<td>2. Who are the participants in these professional development opportunities?</td>
<td>• Include stakeholders</td>
</tr>
<tr>
<td>3. What is the mathematics covered in the professional development opportunities?</td>
<td>• Focus on mathematics content knowledge for instructors</td>
</tr>
<tr>
<td>4. What are the goals of the professional development opportunities?</td>
<td>• Focus on pedagogical knowledge for instructors</td>
</tr>
<tr>
<td></td>
<td>• Focus on mathematics content knowledge for instructors</td>
</tr>
<tr>
<td></td>
<td>• Focus on interaction between instructors to build relationships</td>
</tr>
</tbody>
</table>

**Figure 1**

*Mapping of Research Questions and Recommendations*

Overall, the literature reviewed for this thesis provided suggestions for effective professional development for community college mathematics faculty, which allowed for the creation of a codebook to be utilized during the data collection phase of this
research synthesis. In the methodology chapter that follows, I explain how each of these recommendations that comprise parts of my more specific research questions were operationalized into a codebook to examine the selected papers for this synthesis research.
CHAPTER 3: METHODOLOGY

3.1 Data Collection

Manuscripts were collected from multiple sources for the data collection phase. The manuscripts analyzed were comprised of journal articles, reports, or book sections focused on professional development for community college mathematics faculty. For the purpose of this research synthesis, dissertations and whole books were excluded. The manuscripts were collected from searches performed in ERIC, Social Science Index, Academic Search Complete, and PsycInfo. One search was executed in each of the search engines using the following search terms and conditions.

- ("Professional Development" OR "Professional Training" OR "Staff Development" OR "Faculty Development" OR "Faculty Workshops" OR "Institutes Training Programs")

AND

- ("Mathematics" OR "Mathematics Curriculum" OR "Mathematics Education" OR "Mathematics Instruction" OR "Mathematics Faculty")

AND

- ("Adult Education" OR "Higher Education" OR "Post Secondary Education" OR "Two Year Colleges" OR "Adult Basic Education" OR "Community College")

The following additional search conditions were also designated:

- Available in English

- Published in the last 10 years
- Between 2002 and 2011
- Whole books and dissertations were excluded

The time frame of 2002 to 2011 was selected to keep the data collected relevant and to ensure the size of the data set was manageable.

From ERIC, Academic Search Complete, and PsycInfo search a total of 556 references returned. There were nine references returned from the search of Social Science Index. These references were electronically imported into Refworks, a bibliographic management system, and combined into a reference list in Microsoft Excel. From the list of all references, any duplicates, whole book or dissertation references were removed, resulting in a final list of 475 references to be analyzed for this research synthesis. The 475 references were categorized by the database from which they were imported, as Journal Articles, Reports, or Generic; 343 were journal articles, 97 were reports and 35 were generic.

### 3.2 Data Evaluation

As Cooper (1998) recommends, the data evaluation portion of this thesis was further developed through the creation of sets of questions to determine which of the manuscripts collected should be reviewed and coded. In this study there were two sets of questions: pre-screening and screening. The use of pre-screening and screening questions was adapted from Guskey and Yoon (2009) and Yoon et al. (2007) studies. Guskey and Yoon (2009) implemented the pre-screening phase to determine if manuscripts met their broad criteria for both methodology and relevance to the study.
Once manuscripts passed Guskey and Yoon (2009)’s pre-screening stage they went into the first of three coding phases for their research synthesis. Yoon et al. (2007) suggested utilizing the abstract of each manuscript to help determine the relevance of the manuscript to the study in a pre-screening phase. This suggestion was followed for this synthesis of research and in the pre-screening we examined the abstract only for all papers. In both studies, if a manuscript had an answer of “yes” to each of the pre-screening questions it passed and was then coded (Guskey & Yoon, 2009; Yoon et al., 2007). Similarly, a manuscript was considered irrelevant if any of the pre-screening questions had an answer of “no”, and was therefore not coded (Guskey & Yoon, 2009; Yoon et al., 2007).

### 3.2.1 Pre-Screening

The pre-screening questions were created to determine if the manuscript had potential to be relevant to this research synthesis from the abstract of each manuscript. In general, these questions were to ensure any miscellaneous papers included in the collection of articles were removed before the screening process. The pre-screening questions were as follows:

1. Was manuscript published in between 2002 and 2011?
2. Was the manuscript in English?
3. Was this a reference to a single article, paper, report, or book chapter?
4. Was this manuscript focused on professional development?
5. Was the professional development in the manuscript aimed at community college instructors?

6. Was mathematics the main focus of the professional development?

For a detailed copy of the pre-screening questions see Appendix A. The data set of 475 references was pre-screened by reading only the abstract provided in the references from the search engines. The pre-screening process was conducted using an Excel file. Question 1 and Question 2 were to ensure the manuscripts were within the search criteria utilized during the data retrieval process. The third question was needed to ensure the manuscripts to be coded were relevant to this study. If a manuscript was a collection of papers it could not be ensured that all of the papers included were relevant to this research synthesis.

The abstracts were organized in descending alphabetical order of the primary author’s last name and pre-screening was completed in this order as well. All questions must have been answered with “yes” for that manuscript to pass the pre-screening section. If an answer to a question could not be determined it was marked as “unsure”, which resulted in the manuscript passing the pre-screening stage for that question. However, if any of the pre-screening questions had an answer of “no” the reference did not pass the pre-screening stage and therefore the manuscript did not continue to the screening stage of this research synthesis. A total of 85 manuscripts passed the pre-screening stage, including 75 Journal Articles, 9 Reports, and 1 Generic article.
3.2.2 Screening

For the 85 manuscripts, which passed the pre-screening stage, full texts were retrieved. The full texts were found through means of searching the North Carolina State University (NCSU) library webpage, Google Scholar and utilization of the Tripsaver feature provided through NCSU library; all 85 full manuscripts were retrieved through these means. The papers, which proceeded from the pre-screening process, then went through the screening process. To complete the screening process each of the full text was read by the coder and annotated for applicable information. The screening questions were to ensure any miscellaneous papers included in the collection of articles were removed before the coding process, as well as to gain general information about the manuscript before answering specific questions concerning the professional development being described. The following screening questions were answered in an Excel file by the coder.

1. Was this manuscript focused on professional development?

2. Was the professional development in the manuscript aimed at community college instructors?

3. Was mathematics the main focus of the professional development?

These questions were to ensure each manuscript focused on professional development for community college mathematics faculty, the focus of this thesis. To see the detailed coding scheme and additional descriptions for the screening questions refer to Appendix B. From the 85 manuscripts screened, 14 passed to the coding phase and of
these 12 were journal articles and 2 were reports. It is important to note two of the 14 manuscripts were focused on recommendations for community college or adult mathematics education professional development. These were included due to the small sample size of this study. For the list of all articles coded see Appendix C.

3.3 Data Analysis

3.3.1 Codebook

By recommendation of literature reviewed, each manuscript, which had an answer of “yes” or “unsure” to the pre-screening and screening questions, was then coded using a codebook written in response to the suggestions for effective professional development put forth by American Institutes for Research (2007), Brawer (1990), Darling-Hammond et al. (2009), Kutner and Tibbetts (1997), Guskey and Yoon (2009), and Yoon et al. (2007) and summarized in Chapter 2. Figure 2 provides a mapping between the recommendations from the literature and their operationalization into codebook questions. The description and clarification section for each question in the codebook was created to provide clarification of the question being answered during the coding of manuscripts, for the detailed codebook see Appendix D. These questions were also created to provide data to assist in answering the research questions of this thesis.
Figure 2

*Mapping of Recommendations for Professional Development to Codebook Questions*
### Recommendations from the Literature

**Review**

- Focus on active learning for instructors
- Be sustained over time
- Be coherent with institution goals
- Have structured and sustained follow-up
- Be provided in multiple forms of presentation
- Allow for collective participation
- Include stakeholders

**Codebook Questions**

- Did the professional development utilize student work?
- Did the professional development utilize peer observation?
- How many total hours was the professional development?
- What was the total time span of the professional development?
- Was the professional development aligned with the community colleges’ goals?
- Was there follow up with the participants after the professional development was completed?
- Did instructors have a choice in layout of the professional development?
- What method of contact was utilized during the professional development?
- Who did the instructors attend the professional development with?
- Who were the instructors attending the professional development?
- What other stakeholders were involved in the professional development?
<table>
<thead>
<tr>
<th>Focus on mathematics content knowledge for instructors</th>
<th>Was the professional development focused on content for a specific course?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Was one of the goals of the professional development subject matter knowledge or mathematics content?</td>
</tr>
<tr>
<td>Focus on pedagogical knowledge for instructors</td>
<td>Was one of the goals of the professional development pedagogical content knowledge in mathematics?</td>
</tr>
<tr>
<td></td>
<td>Were there connections between activities and the practice of teaching?</td>
</tr>
<tr>
<td>Focus on interaction between instructors to build relationships</td>
<td>Was instructor community a goal of the professional development?</td>
</tr>
</tbody>
</table>
Overall, the coding work for this thesis was based on the following codebook questions.

1. Who were the instructors attending the professional development?
2. Was one of the goals of the professional development subject matter knowledge or mathematics content?
3. Was one of the goals of the professional development pedagogical content knowledge in mathematics?
4. Was instructor community a goal of the professional development?
5. Was the professional development aligned with the community colleges’ goals?
6. Was the professional development focused on content for a specific course?
7. Were there connections between activities and the practice of teaching?
8. Did instructors have a choice in layout of the professional development?
9. What method of contact was utilized during the professional development?
10. How many total hours was the professional development?
11. What was the total time span of the professional development?
12. Did the professional development utilize student work?
13. Did the professional development utilize peer observation?
14. Who did the instructors attend the professional development with?
15. What other stakeholders were involved in the professional development?
16. Was there follow up with the participants after the professional development was completed?
3.3.2 Coding

After the codebook was finalized the questions and the appropriate answer choices were entered into an Excel file, where the coding for each manuscript occurred. This file contained the coding questions, description/clarification of the question, answer format for each question and conversions, from qualitative to quantitative data formats, for the answers provided, as seen in Appendix D. The full texts of each manuscript were read in their entirety and pertinent information was highlighted. Each manuscript had a row in the Excel file dedicated to its coding answers. The answers to the coding questions were entered using the provided answer choices. For some of the coding questions one of the answer choices was “not reported”. This answer selection indicates that the author did not report on that particular aspect of the professional development, not that it did not occur. The data obtained through the coding process was a mix of qualitative and quantitative responses; therefore a descriptive analysis was prepared utilizing frequency counts and percentages for the various questions. The findings are discussed in the next chapter.
CHAPTER 4: RESULTS

4.1 Data Analysis and Interpretation

This study focused on the description of professional development for community college mathematics faculty. The manuscripts evaluated for this research synthesis were collected from ERIC, Academic Search Primer, Social Science Index and PsycInfo databases and were published between 2002 and 2011. Overall, there was a wide variety in the description of the professional development opportunities offered to the community college instructors. Also, there were a large number of variables which could not be coded in this study because no information about these variables was provided in the manuscripts.

The data presented in this chapter is a summarization of the coding results obtained from the 14 manuscripts. The results are organized according to their relevance to the four research questions. Due to the small sample size and the categorical nature of the data, the data analysis is descriptive only.

4.1.1 Research Question 1

*Are features of professional development that are recommended for K-12 teachers present in professional development for community college mathematics faculty?*

To assist in answering Research Question 1 there were eight variables in each manuscript coded. Table 1, below, summarizes the results of the variables that were coded in Research Question 1. For the most part, the features of professional
development recommended for K-12 teachers are present in the community college mathematics faculty professional development.

Table 1

Summary of Coding of Variables of Interest for Research Question 1

<table>
<thead>
<tr>
<th>Manuscript Coded</th>
<th>Use of Student Work</th>
<th>Use of Peer Observation</th>
<th>Total Contact Hours</th>
<th>Total Time Span</th>
<th>Alignment with Community Colleges' Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Yes</td>
<td>-</td>
<td>4 to 52 hrs</td>
<td>2 days to 1 year</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>No</td>
<td>No</td>
<td>-</td>
<td>2 years</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>Yes</td>
<td>No</td>
<td>36 hrs</td>
<td>6 months</td>
<td>Yes</td>
</tr>
<tr>
<td>4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>Yes</td>
<td>No</td>
<td>-</td>
<td>5 years</td>
<td>Yes</td>
</tr>
<tr>
<td>6</td>
<td>No</td>
<td>No</td>
<td>36 hrs</td>
<td>3 years</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>No</td>
<td>Yes</td>
<td>36 hrs</td>
<td>5 months</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>Yes</td>
<td>Yes</td>
<td>-</td>
<td>32 weeks</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>No</td>
<td>No</td>
<td>-</td>
<td>5 months</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>Yes</td>
<td>No</td>
<td>2.25 hrs to 27 hrs</td>
<td>9 months</td>
<td>-</td>
</tr>
<tr>
<td>11</td>
<td>Yes</td>
<td>No</td>
<td>24 hrs to 36 hrs</td>
<td>9 months</td>
<td>-</td>
</tr>
<tr>
<td>12</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>13</td>
<td>No</td>
<td>No</td>
<td>15 hrs</td>
<td>4 years</td>
<td>-</td>
</tr>
<tr>
<td>14</td>
<td>-</td>
<td>-</td>
<td>12 hrs to 84 hrs</td>
<td>4 years</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Note. “-” indicates the manuscript did not report on this variable.
Table 1 Continued

<table>
<thead>
<tr>
<th>Manuscript Coded</th>
<th>Presence of Follow-up</th>
<th>Instructor Choice in Layout</th>
<th>Method of Contact</th>
<th>Who did Instructor Attend with?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Yes</td>
<td>-</td>
<td>Blended</td>
<td>Individual instructors</td>
</tr>
<tr>
<td>2</td>
<td>Yes</td>
<td>-</td>
<td>Face-to-face</td>
<td>Individual instructors</td>
</tr>
<tr>
<td>3</td>
<td>Yes</td>
<td>-</td>
<td>Face-to-face</td>
<td>Individual instructors</td>
</tr>
<tr>
<td>4</td>
<td>-</td>
<td>-</td>
<td>Face-to-face</td>
<td>Individual instructors</td>
</tr>
<tr>
<td>5</td>
<td>-</td>
<td>-</td>
<td>Face-to-face</td>
<td>Individual instructors</td>
</tr>
<tr>
<td>6</td>
<td>Yes</td>
<td>-</td>
<td>Face-to-face</td>
<td>Individual instructors</td>
</tr>
<tr>
<td>7</td>
<td>-</td>
<td>-</td>
<td>Face-to-face</td>
<td>Individual instructors</td>
</tr>
<tr>
<td>8</td>
<td>-</td>
<td>-</td>
<td>Face-to-face</td>
<td>With peers from their department</td>
</tr>
<tr>
<td>9</td>
<td>-</td>
<td>-</td>
<td>Blended</td>
<td>Individual instructors</td>
</tr>
<tr>
<td>10</td>
<td>-</td>
<td>-</td>
<td>Face-to-face</td>
<td>Individual instructors</td>
</tr>
<tr>
<td>11</td>
<td>-</td>
<td>-</td>
<td>Face-to-face</td>
<td>Individual instructors</td>
</tr>
<tr>
<td>12</td>
<td>-</td>
<td>Yes</td>
<td>Face-to-face</td>
<td>Individual instructors</td>
</tr>
<tr>
<td>13</td>
<td>-</td>
<td>-</td>
<td>Online only</td>
<td>Individual instructors</td>
</tr>
<tr>
<td>14</td>
<td>Yes</td>
<td>Yes</td>
<td>Face-to-face</td>
<td>Individual instructors</td>
</tr>
</tbody>
</table>

Note. “-” indicates the manuscript did not report on this variable.

The lack of reporting for instructors’ choice in layout could indicate it was either not offered to the instructors or it was offered and the authors chose not to report it in their manuscript. Surprisingly, the majority of the professional development only included face-to-face interaction and only three utilized online involvement in any capacity. The reported contact hours and total time span are summarized in Table 2. Data for only 12 manuscripts are presented in Table 2 because two manuscripts did not report on total hours or time span. For the seven manuscripts which reported the contact hours, they
ranged from 2.25 hours to 84 hours. For the 11 manuscripts that did report a time span, it ranged from 2 days to 4 years.

**Table 2**

*Total Number of Hours and Total Time Span for the Professional Development*

<table>
<thead>
<tr>
<th>Manuscript Coded</th>
<th>Total Number of Hours</th>
<th>Total Time Span</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4 to 52 hours</td>
<td>2 days to 1 year</td>
</tr>
<tr>
<td>2</td>
<td>-</td>
<td>2 years</td>
</tr>
<tr>
<td>3</td>
<td>26 hours</td>
<td>6 months</td>
</tr>
<tr>
<td>5</td>
<td>-</td>
<td>5 years</td>
</tr>
<tr>
<td>6</td>
<td>36 hours</td>
<td>3 years</td>
</tr>
<tr>
<td>7</td>
<td>-</td>
<td>5 months</td>
</tr>
<tr>
<td>8</td>
<td>-</td>
<td>32 weeks</td>
</tr>
<tr>
<td>9</td>
<td>-</td>
<td>5 months</td>
</tr>
<tr>
<td>10</td>
<td>2.25 to 27 hours</td>
<td>9 months</td>
</tr>
<tr>
<td>11</td>
<td>24 to 36 hours</td>
<td>9 months</td>
</tr>
<tr>
<td>13</td>
<td>15 hours</td>
<td>4 years</td>
</tr>
<tr>
<td>14</td>
<td>12 to 84 hours</td>
<td>-</td>
</tr>
</tbody>
</table>

*Note: “-” indicates this value was not reported.*

The total number of hours and total time span coded varied widely between professional development opportunities. The length of meetings ranged in time as well as frequency between professional development sessions. Many of these manuscripts reported on the professional development opportunity overall, and also referenced the length of the meetings and total time span as ranges. In general, the total number of contact hours and total time spans reported were in line with the K-12 and community college recommendations.
The small number of manuscripts reporting the use of peer observation was surprising, since this variable was an important recommendation for the professional development from the literature reviewed. The majority of manuscripts did not report on follow-up. However, those who did report on the use of follow-up with their professional development utilized it. Interestingly, only one manuscript reported instructors attended the professional development with peers from their department. This was interesting as some of the professional developments reported building instructor community as a goal, even when instructors attended as individuals. In general, the mathematics instructors attended the professional development as an individual. Overall, most of the recommended features of K-12 professional development are found in community college mathematics professional development.

4.1.2. Research Question 2

*Who are the participants in these professional development opportunities?*

From the information obtained by applying the first codebook question to the 14 manuscripts coded for this research synthesis, five of the professional development opportunities were focused on community college mathematics instructors and four were focused on adult numeracy instructors. Taking into consideration the small sample size, manuscripts that only referred to the audience for the professional development as “faculty” or “college level” were kept despite the vagueness of their intended target audiences. The table below shows the breakdown of the target audiences for the 14 manuscripts of professional development opportunities.
Table 3

Target Audience of the 14 Manuscripts Coded

<table>
<thead>
<tr>
<th>Target Audience</th>
<th>Number of Manuscripts</th>
<th>Percent of Manuscripts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community College Instructors</td>
<td>5</td>
<td>35.71%</td>
</tr>
<tr>
<td>Adult Numeracy Instructors</td>
<td>4</td>
<td>28.57%</td>
</tr>
<tr>
<td>College Faculty</td>
<td>2</td>
<td>14.29%</td>
</tr>
<tr>
<td>Faculty</td>
<td>1</td>
<td>7.14%</td>
</tr>
<tr>
<td>College Level Mathematics Instructors</td>
<td>1</td>
<td>7.14%</td>
</tr>
<tr>
<td>Adult Education Instructors</td>
<td>1</td>
<td>7.14%</td>
</tr>
</tbody>
</table>

Were other stakeholders involved? Eight manuscripts reported other stakeholders being involved in the professional development. In three of the manuscripts, the other stakeholders involved were other instructors beyond those who taught mathematics. The remaining five papers that included other stakeholders included one or more of the following: secondary mathematics teachers, university faculty, K-12 mentor teachers, alternative certification interns, instructors from drug retention centers, instructors from private training companies, sixth form college instructors, and instructors from local authority adult education centers. Some manuscripts included more than one of the above listed stakeholders. Six manuscripts reported that no other stakeholders were involved in the professional development. The inclusion of stakeholders was a very important recommendation from the
community college literature and K-12 literature, however only eight manuscripts reported on other stakeholders being involved in the professional development.

Overall, for Research Question 2, the answer is that the majority of the participants in the professional development opportunities were community college mathematics instructors and adult numeracy instructors. Many of the professional development opportunities also included other stakeholders.

4.1.3 Research Question 3

What is the mathematics covered in the professional development opportunities?

This question was investigated through looking at the mathematics content of focus during the professional development. Eight manuscripts did not report on the content of the professional development. Of the six that did report on the content, the following was reported: five focused on basic skills/adult numeracy and one focused on number, data, geometry, and algebra. Forty nine percent of the manuscripts reported that the mathematics content was included in the professional development. Not surprisingly, this included basic skills mathematics, adult numeracy, number, data, geometry and algebra. This content is expected, as the groups of instructors of focus for the professional development were community college mathematics instructors and adult numeracy instructors. Generally, the content covered in community college mathematics faculty professional development was focused on basic skills mathematics.
4.1.4 Research Question 4

*What are the goals of the professional development opportunities?*

To further understand the goals of the professional development the following were coded: subject matter knowledge or mathematics content, pedagogical content knowledge, and teacher community. If the goals were not mentioned in the manuscript then it was coded as not a goal. Content knowledge or mathematics content was coded as the goal of the professional development for three and it was coded as not one of the goals for 11. Pedagogical content knowledge was coded as the goal of their professional development in 14 manuscripts. Finally, teacher community was coded as the goal of the professional development in five, and in nine it was not one of the goals. None of the manuscripts reported all three were goals of the professional development.

To further investigate the focus of pedagogical content knowledge, the connection between activities in the professional development and practice was coded. Twelve manuscripts reported that connection to practice was an important part of the activities; one reported that connection to practice was one of many parts of the activities, zero indicated there were no activities with connection to practice, and one did not report on connections to practice. Connections to practice were also a very important aspect of the professional development according to the literature. Eighty six percent of the manuscripts reported it was an important part of the activities offered in their professional development.
To also assist in answering the fourth research question the manuscripts were coded for their alignment with the community college’s goals. Three manuscripts reported being aligned with these goals and 11 did not report on their alignment with the community college’s goals. Table 4 shows the coding for the goals reported in the 14 manuscripts coded. Overall, the goal for the professional development opportunities for community college mathematics faculty was pedagogical content knowledge.

Table 4

Overview of the Goals of each Professional Development Coded

<table>
<thead>
<tr>
<th>Was one of the goals of the professional development subject matter knowledge or mathematics content?</th>
<th>Was one of the goals of the professional development pedagogical content knowledge in mathematics?</th>
<th>Was teacher community a goal of the professional development?</th>
<th>Was the professional development aligned with the community colleges goals?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>-</td>
</tr>
<tr>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>-</td>
</tr>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>-</td>
</tr>
<tr>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>-</td>
</tr>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>-</td>
</tr>
<tr>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>-</td>
</tr>
<tr>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>-</td>
</tr>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>-</td>
</tr>
<tr>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>-</td>
</tr>
<tr>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>-</td>
</tr>
<tr>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>-</td>
</tr>
<tr>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Note. “-“ indicates the manuscript did not report on this variable.
Generally, the participants in the professional development examined were community college mathematics instructors or adult numeracy instructors. The community college professional development ranged from 2.25 hours to 84 hours with a total time span up to 4 years. Instructors typically attended their professional development as individuals even though it was recommended they participate with others from their department. Content was an important focus of the professional development and the professional development’s activities were connected to practice. However, the goals of these professional developments were always at least focused on pedagogy. Occasionally, they also focused on subject matter knowledge or instructor community.
CHAPTER 5: DISCUSSION

5.1 Presentation of Results

This study focused on examining the field of professional development for community college mathematics instructors. It entailed a synthesis of the professional development for community college mathematics instructors that were reported in manuscripts published between 2002-2011 in journals that can be searched through Academic Search Complete, ERIC, Social Science Index, and PsycInfo databases. A total of 475 were initially examined, with 14 being coded after passing all the selection criteria. Generally, there was wide variation among the reported descriptions of community college mathematics professional development in these manuscripts. There were also a large number of variables that were not reported in these examined published papers. However, some important conclusions can be made.

Taking all of the above information into consideration, the results of the coding for goals of the professional development were interesting. Of the three goals coded in this thesis, it was interesting that every professional development reported pedagogy was a goal. Originally, I expected a more diverse reporting of the goals for the professional developments because of the recommendations found in the literature review. From these recommendations, I anticipated the goals of pedagogical knowledge, mathematics content knowledge, and instructor community would be points of focus. I came to this conclusion because these were discussed the most and recommended by a majority of the papers. However, taking into consideration the
highest degree of community college instructors is either a master’s or doctor’s degree in the discipline they teach, it is understandable that pedagogy would be the main goal for professional development. These degrees most likely indicate a mastery of content knowledge with limited formal pedagogical training. For reporting of the goals the manuscripts could have only reported the most important goal of the professional development at the time of publication, instead of reporting all of the goals.

The majority of manuscripts, which reported on the content covered in the professional development, stated it was focused on adult numeracy/basic skills. This is not surprising as four of the 14 professional development opportunities were for adult numeracy instructors. This high reporting of adult numeracy content led me to believe that the professional development for community college mathematics instructors could have been focused on adult numeracy instructors. This focus on content was interesting since only three of the manuscripts reported having a goal of mathematics content knowledge. Content may have been utilized during the professional developments as a directly applicable avenue to present pedagogical content knowledge to the instructors. However, some of the professional developments chose to at least partially focus on the content being utilized.

On average the total number of contact hours was on average 29 hours. The K-12 literature reviewed in this study recommended 30 to 100, 30 or more, and 14 or more contact hours for effective professional development, respectively (Darling-Hammond et al., 2009; Guskey & Yoon, 2009; Yoon et al., 2007). According to these
recommendations the average total number of contact hours could be considered in the range for effective professional development. Five of the seven, which reported total number of hours, would fall into this classification.

The inclusion of content in the professional development would be expected to indicate a connection to practice. Interestingly, 85.7% of the manuscripts reported that connection to practice was an important part of the activity. This would help explain why the majority of the professional development opportunities utilized content in their activities. However, with this importance of connections to practice, I would have expected more professional developments that utilized student work in the activities of the professional development, which was not the case.

Many times, student work is used in professional development to engage instructors in discussions about the mathematics students learn and the strategies used to solve problems. Based upon the reported goals, student work was most likely not used in the professional development reported in these manuscripts because of the stronger focus on pedagogy as opposed to subject matter content knowledge. The use of student work and peer observation in the professional development was reported as not utilized in the majority of manuscripts.

The lack of peer observation being utilized in the coded reports of professional developments could have been due to the fact that all but one reported attending the professional development as an individual so they did not have other instructors in their area with which to coordinate. Additionally, this lack of use of peer observation
could have been due to time constraints in the professional development. These manuscripts were focused on mathematics instructors so the authors may have neglected to report the entire department went to the professional development. I hypothesize it was not reported as departments or teams from departments because all instructors were expected to attend the professional development. Therefore, the authors may not have thought the information was relevant to their description of the professional development at the time of publication. The reporting of individual teachers attending the professional development could be attributed to instructors being found through individual invitations or on a first come first serve basis without departmental tracking.

Most manuscripts did not provide information regarding features of professional development that are deemed important for its effectiveness. This is a problem for the field because the lack of information hinders the discussion about quality in professional development opportunities offered to community college mathematics instructors. Authors may not have reported on these variables because they did not find them relevant to their manuscript at the time of publication. However, this could have also occurred because these opportunities were not part of the professional development. Many of the manuscripts did not report on the alignment of the professional development to the community college’s goals. This could have occurred because the authors did not find the information pertinent to the articles they were publishing. Another aspect of unreported variables is the lack of information included
in the manuscripts regarding choice in layout for the professional development. This could be a result of lack of funding for multiple format presentations of professional development.

5.1.1 Interesting Case

One manuscript was particularly interesting since the coding was different than the rest of the manuscripts for almost all of the attributes coded. This manuscript was part of the New Direction for Community Colleges journal in 2009. The study was conducted at the Pasadena City College’s Teaching and Learning Center in California’s community college system. It is interesting that this manuscript was published in 2009 following publication of recommendations for K-12 mathematics professional development. It was the only manuscript which reported that instructors attended the professional development with peers from their department. The professional development was a total of 32 weeks of face-to-face work. It was reported that the goals of the professional development were pedagogy and instructor community but focused mainly on pedagogical content knowledge. The professional development focused on basic skills mathematics content where the activities were connected to practice. The activities utilized included the use of student work and peer observation. Also included in this professional development were other instructors at the community college beyond those who teach mathematics. This professional development reported on 12 out of the 16 attributes being coded in this research synthesis. The reported success of this professional development was most likely due
to the team strategy utilized from start to finish when tackling improving instructors’ pedagogy. Throughout this professional development faculty were actively engaged with their peers, as well as other faculty, when furthering their mathematics content knowledge and pedagogical content knowledge. The inclusion of multiple presentations of activities optimized the instructors learning outcomes.

5.2 Limitations

The sample of 14 manuscripts coded for this research synthesis does not represent the entire field of community college mathematics professional development. This sample represents only those manuscripts reporting that they were for mathematics professional development and were published in the databases used in this synthesis: Academic Search Premier, ERIC, Social Science Index, and PsycInfo databases. I acknowledge there is a vast amount of professional development which occurs for community college faculty in mathematics that is not written about or published. It should also be acknowledged that other professional development opportunities are documented, but published with databases other than those utilized in this research synthesis. The search terms utilized in the data collection phase of this study may not have captured all of the manuscripts relevant to this study. However, these limitations were accepted to keep this study within achievable size and time limits.

The list of recommendations for professional development for mathematics faculty was based on the literature review of K-12 and community college
recommendations for professional development. However, this list was only based on
the relevant documents found through ERIC and the NCSU library; therefore, this list
may not be all-inclusive.

At the time of coding, the coder’s interpretations of meaning could have been
different than the authors intended meaning of the text. Additionally, due to the
variations in writing styles between authors of the manuscripts, consistency in coding
certain variables could differ across the coded manuscripts. Results of this study are
limited by the small sample size and the results should be analyzed accordingly. Also,
due to the number of manuscripts which did not report on certain aspects of the
professional development, results for particular attributes could be skewed. In many
cases an attribute could have been present in the professional development but the
author did not find it relevant to report on that attribute at the time of publication.

5.3 Implications

This research synthesis was focused on what the literature reported for
mathematics professional development at the community college level. This study
found the recommendations from K-12 professional development were also found in
the community college professional development. This could be due to the fact that
many researchers are amending K-12 recommendations to fit community college
settings based on the recommendation of the American Institute for Research’s
suggestion. These generalizations would be appropriate since the mathematical
content and instructional goals are very similar. Pedagogical content knowledge is
comparable between K-12 and adult numeracy classrooms. However, not all mathematics instructors at the community college level can use similar pedagogical skills as K-12 because of the demographics of the population in the classrooms. Therefore, it is important to take into account the differences in student population.

Future community college mathematics professional development should be structured with a specific goal for the professional development. These goals should be pedagogical content knowledge, mathematics content knowledge or instructor community. Also, professional development should include teams or whole departments instead of individual instructors. Most importantly, journal articles should be published describing professional development offerings to help inform other community colleges of the professional development initiatives being utilized. From the results of this thesis the following variables, at minimum, of professional development should be reported in these articles: goals of the professional development, mathematics content covered, activities utilized, and all stakeholders involved.

Further examination is needed to obtain more information regarding the incorporation of recommendations into community college professional development for mathematics instructors. It would be interesting to explore the various types of professional development for community college faculty which are being pursued. This exploration could be utilized to investigate why so few professional development opportunities are recorded and published. Another interesting investigation would be
comparing mathematics professional development opportunities with those for instructors who teach in other content areas.

This thesis has provided insight into the practice of professional development at the community college level. As I transition into the role of instructor in post-secondary education, it will become increasingly important to stay informed in emerging methodologies of instruction and student engagement. It is my goal to utilize this information while becoming involved in community college mathematics professional development.
REFERENCES


## Appendix A

**Pre-Screening Questions**

<table>
<thead>
<tr>
<th>Question</th>
<th>Description/Clarification</th>
<th>Answer format</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PRE-SCREENING QUESTIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Was manuscript published in between 2002 and 2011?</td>
<td></td>
<td>Yes/No</td>
</tr>
<tr>
<td>Was the manuscript in English?</td>
<td></td>
<td>Yes/No</td>
</tr>
</tbody>
</table>
| Was this a reference to a single article, paper, report, or book chapter? | Answer **NO** if:  
  • reference is for yearbooks, proceedings, monographs, reports, or books that have multiple chapters each prepared by different authors  
    • full collection of papers that is listed as one reference but includes various authors | Yes/No                 |
| Was this manuscript focused on professional development?                | Answer **NO** if:  
  • study was focused on pre-service teacher preparation  
  • study was focused on comprehensive reform models, curriculum, instructional models, instruction, classroom practices, teaching materials, assessment, or policies with little attention to professional development as a primary focus  
  • study has professional development as part of its recommendation  
  Answer **YES** if:  
  • study describes work done with instructors even though it does not call it professional development, such as watching videos, analyzing school data together, solving weekly math | Yes/No/Unsure          |
<table>
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<tr>
<th>Question</th>
<th>Answer</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td>problems, etc.</td>
<td></td>
<td>• study describes a larger project that engaged instructors with the goal of improving instruction or achievement</td>
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<tr>
<td>• study was about professional development for practicing instructors at any level such as K-12 teachers, universities, pre-school, museums, etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Was the professional development in the manuscript aimed at community college instructors?</td>
<td>Answer <strong>NO</strong> if:</td>
<td>• professional development focused on K-12 teachers;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• professional development focused on after school programs or informal educators (museums, zoos, etc)</td>
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<td></td>
<td></td>
<td>• professional development focused on community college administrators or stakeholders other than instructors</td>
</tr>
<tr>
<td>Was mathematics the main focus of the professional development?</td>
<td>Answer <strong>NO</strong> if:</td>
<td>• the professional development was not offered to math instructors; that is, the professional development's audience does not teach math</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• the professional development was about other disciplines such as science, English, technology, etc with no explicit indication of connections to mathematics instruction as part of the content</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• the professional development was about general teaching or pedagogical issues, including mathematics as one of many topics addressed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• the professional development was about general pedagogical issues and examines mathematics as one of many applications for the pedagogy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• the professional development was about general pedagogical issues and mathematics is only used as part of outcome measures of the professional development effectiveness</td>
</tr>
<tr>
<td>Proceed with analysis of the paper?</td>
<td>Yes/No</td>
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</table>

Answer **YES** if:
- the professional development audience included instructors other than mathematics instructors, but the focus of the professional development was related to mathematics teaching and the audience is mathematics instructors or not specified
- the professional development was about applications to mathematics instruction of pedagogical issues such as assessment, teaching language learners sense of self-efficacy, new standards, instructional tools and the audience is mathematics instructors or not specified

Answer **STEM** if:
- the professional development includes any combinations of the STEM disciplines that has mathematics as one of the issues addressed and the audience is mathematics instructors or not specified
### Appendix B

## Screening Questions

<table>
<thead>
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<th>Question</th>
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<th>Answer format</th>
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</thead>
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<tr>
<td><strong>SCREENING QUESTIONS</strong></td>
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<td>Yes/No</td>
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</tbody>
</table>
| Was this manuscript focused on professional development? | Answer **NO** if:  
• study was focused on pre-service teacher preparation  
• study was focused on comprehensive reform models, curriculum, instructional models, instruction, classroom practices, teaching materials, assessment, or policies with little attention to professional development as a primary focus  
• study has professional development as part of its recommendation  

Answer **YES** if:  
• study described work done with instructors even though it does not call it professional development, such as watching videos, analyzing school data together, solving weekly math problems, etc.  
• study described a larger project that engaged instructors with the goal of improving instruction or achievement  
• study was about professional development for practicing instructors at any level such as K-12 teachers, universities, pre-school, museums, etc. |               |
| Was the professional development in the manuscript aimed at community college instructors? | Answer **NO** if:  
• professional development focused on K-12 teachers;  
• professional development focused on after school programs or informal educators (museums, zoos, etc)  
• professional development focused on community college administrators or stakeholders other than instructors | Yes/No        |
<table>
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<th>Question</th>
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<th>Yes if:</th>
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<tr>
<td>Was mathematics the main focus of the professional development?</td>
<td>• the professional development was not offered to math instructors; that is, the professional development’s audience does not teach math</td>
<td></td>
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<tr>
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<td>• the professional development was about other disciplines such as science, English, technology, etc with no explicit indication of connections to mathematics instruction as part of the content</td>
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<td>• the professional development was about general pedagogical issues and examines mathematics as one of many applications for the pedagogy</td>
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<tr>
<td></td>
<td>• the professional development was about general pedagogical issues and mathematics is only used as part of outcome measures of the professional development effectiveness</td>
<td></td>
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<td></td>
<td><strong>Answer YES if:</strong></td>
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<tr>
<td></td>
<td>• the professional development audience included instructors other than mathematics instructors, but the focus of the professional development was related to mathematics teaching and the audience is mathematics instructors or not specified</td>
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<tr>
<td></td>
<td>• the professional development was about applications to mathematics instruction of pedagogical issues such as assessment, teaching language learners sense of self-efficacy, new standards, instructional tools and the audience is mathematics instructors or not specified</td>
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</tr>
<tr>
<td>Screening decision</td>
<td>Proceed with analysis of the paper?</td>
<td>Yes/No</td>
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<tr>
<td>Answer STEM if:</td>
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<tr>
<td>• the professional development included any combinations of the STEM disciplines that have mathematics as one of the issues addressed and the audience is mathematics instructors or not specified</td>
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Appendix C

Articles Coded


## Appendix D

### Codebook

<table>
<thead>
<tr>
<th>Question</th>
<th>Description/Clarification</th>
<th>Answer format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citation of Article</td>
<td>Use APA format</td>
<td></td>
</tr>
<tr>
<td>Who were the instructors attending the professional development?</td>
<td>Enter information about the program affiliation of the instructors attending the professional development.</td>
<td>Enter information or indicate not reported.</td>
</tr>
<tr>
<td>Was one of the goals of the professional development subject matter knowledge or mathematics content?</td>
<td>Develop instructors’ in-depth understanding of mathematics or specific concepts within mathematics such as fractions, numbers, pre-calculus, etc. The focus was on helping instructors strengthen their knowledge of mathematics or mathematics for teaching. The focus was on the discipline of mathematics or mathematics content.</td>
<td>Yes, No, Not reported</td>
</tr>
<tr>
<td>Was one of the goals of the professional development pedagogical content knowledge in mathematics?</td>
<td>Develop instructors’ understanding of various instructional and pedagogical approaches used in mathematics classroom, such as: using manipulatives, questioning techniques, promoting mathematics discourse, establishing sociomathematical participation norms, using or adapting existing curriculum materials or units for specific purposes, selecting appropriate mathematical tasks, etc. The main focus was on specific facets of teaching of mathematics (not the students or the content or the textbook or the general view of math teaching, although it may mention students, content, textbooks, and vision of math).</td>
<td>Yes, No, Not reported</td>
</tr>
<tr>
<td>Question</td>
<td>Description</td>
<td>Response Options</td>
</tr>
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<tr>
<td>Was instructor community a goal of the professional development?</td>
<td>Develop a community of instructors, instructors’ interactions with their peers, or instructors’ belonging into a group of instructors. This goal often relates to increasing discourse and communication among instructors, giving instructors professional sharing opportunities.</td>
<td>Yes, No, Not reported</td>
</tr>
<tr>
<td>Was the professional development aligned with the community colleges goals?</td>
<td>Indicate if the professional development activities in which instructors participated were designed to meet state or school goals</td>
<td>Yes, No, Not reported</td>
</tr>
<tr>
<td>Was the professional development focused on content for a specific course?</td>
<td>Indicate if professional development was designed to address the content of particular courses. If so enter the type of course the professional development was focused on.</td>
<td>Enter information or indicate not reported.</td>
</tr>
<tr>
<td>Were there connections between activities and the practice of teaching?</td>
<td>Indicate whether there was an intentional attempt to connect professional development activities to the practice of teaching or to use the practice-based activities or artifacts in the professional development. This connection to practice can be specifically stated in the professional development or it can be noted by the choice of activities that are about teaching or related to the practice of teaching.</td>
<td>Choose One: connection to practice was important part of activities, connection to practice was one of many parts of the activities, there were no activities connected to practice, connections to practice were not reported</td>
</tr>
<tr>
<td>Did instructors have a choice in layout of the professional development?</td>
<td>Where there different formats available for the instructors to choose from?</td>
<td>Yes, No, Not reported</td>
</tr>
<tr>
<td>Question</td>
<td>Description</td>
<td>Options</td>
</tr>
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<td>-------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>What method of contact was utilized during the professional development?</td>
<td>Indicate whether the professional development contact hours were delivered online or face-to-face. The professional development hours refer to the interactions among participants that also include participation or monitoring from the professional development providers or facilitators. Use of email and other communication devices that does not include all participants and facilitators does is not considered &quot;professional development contact.&quot;</td>
<td>Face-to-Face only; Online only; Blended; Not Reported</td>
</tr>
<tr>
<td>How many total hours was the professional development?</td>
<td>Total number of hours spent on the professional development activities. When the report indicated number of days instead of hours, count each day as 6 hours of professional development.</td>
<td>Enter number of hours or indicate not reported.</td>
</tr>
<tr>
<td>What was the total time span of the professional development?</td>
<td>The total length of time from beginning to end of the intervention; it does not mean that the intervention was evenly spread or occurred regularly throughout the whole span, but indicates how long it took for all the contact hours to be delivered from the first to the last contact time with participants, despite breaks in between (so, a professional development with a summer institute and monthly school meetings can have a 10-month total span).</td>
<td>Enter days, weeks, months, years, or indicate not reported. Choose most appropriate unit to indicate total span.</td>
</tr>
<tr>
<td>Did the professional development utilize student work?</td>
<td>Did participants look at samples of community college student work? This work could come from other participants or outside sources.</td>
<td>Yes, No, Not reported</td>
</tr>
<tr>
<td>Did the professional development utilize peer observation?</td>
<td>Peer observation could occur face-to-face, through the use of video, or through other technological means.</td>
<td>Yes, No, Not reported</td>
</tr>
<tr>
<td>Question</td>
<td>Response</td>
<td>Options</td>
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<td>-------------------------------------------------------------------------</td>
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<tr>
<td>Who did the instructors attend the professional development with?</td>
<td>Did the instructors attend on their own, with peers from their department, with their whole department, with the entire college, or with a peer from outside their department?</td>
<td>Individual instructors, Teams from departments, Whole departments, Whole institutions, Teams from institutions, Other (please specify)</td>
</tr>
<tr>
<td>What other stakeholders were involved in the professional development?</td>
<td>Indicate if professional development included state administrators, institution administrators, other community college staff, etc. When there is no information about including other stakeholders, assume there were only instructors in the professional development and therefore there are no other participating stakeholders.</td>
<td>No other stakeholders; Other instructors beyond those who teach mathematics; Teaching assistants; College administrators; Department heads; Others (enter information)</td>
</tr>
<tr>
<td>Was there follow up with the participants after the professional development was completed?</td>
<td>Are instructors evaluated or followed-up on the outcomes of professional development? Any consequences of professional development? Any assessment of professional development effects? Linked to instructor evaluation? Is there further support provided to instructors after the professional development is completed?</td>
<td>Yes, No, Not Reported</td>
</tr>
</tbody>
</table>