EXPLORING PROFESSIONAL DEVELOPMENT EXPERIENCES:

TEACHERS' AND FACILITATORS' PERCEPTIONS

OF ALABAMA SCIENCE IN MOTION

by

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ABSTRACT

Teachers are often disillusioned because most of the professional development that they receive is inadequate (Chappuis, Chappuis, & Stiggins, 2009; Borko, 2004). With that in mind, reform efforts have placed attentive measures on the classroom and the way teachers can improve their instructional practices.

The purpose of this study was to explore biology and chemistry teachers' and facilitators' perceptions of the Alabama Science in Motion (ASIM) professional development experience. Furthermore, the researcher conducted this study to determine whether or not ASIM had an impact on teachers' classroom instruction. The results of this study were significant in that it allows for policy makers to analyze the effect that the ASIM experience has on reforming and restructuring science education. A mixed-method research design was utilized. Data was gathered from teachers and facilitators via survey and focus group interview responses. The population consisted of teachers who were trained with ASIM modules and facilitators who trained teachers in the area of biology and chemistry. A statistical data analysis was employed using the Pearson r correlation coefficient test (Pearson *r*).

The results of this study revealed that effective professional development has an impact on teachers' classroom instruction. Teachers and facilitators believed that ASIM made them more effective as a teacher and contributed strongly to their students' understanding of biology and chemistry. Moreover, teachers and facilitators believed that the ASIM modules assisted them in the implementation of the standards on the Alabama Course of Study.

DEDICATION

This dissertation is dedicated to my mother, Elizabeth S. Mixon, whom I lost July 1, 2010. I know that she is so very proud of her baby! Her love and encouragement at the start of this endeavor are two reasons why I was able to persevere and endure to the end. She taught me to stay strong, follow my dreams and never give up. The work ethics she instilled in me as a child made me the person, mother and professional I am today. I will keep her spirit in my heart forever. I love you, Mommy!

LIST OF ABBREVIATIONS

AlaHASP	Alabama Hands-On Activity Science Program
ALCOS	Alabama Course of Study
AMSTI	Alabama Math, Science, and Technology Initiative
ASIM	Alabama Science in Motion
ETS	Educational Testing Services
HASP	Hands-On Activity Science Program
NAEP	National Assessment of Educational Progress
NCES	National Center for Education Statistics
NCMST	National Commission on Teaching and America's Future
NCLB	No Child Left Behind
PBS	project-based science
SPSS	Statistical Program for the Social Sciences
TIMSS	Third International Math and Science Study

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Philippians 4:13 says, "I can do all things through Christ who strengthens me." Without my Lord and Savior, Jesus Christ, none of this would have been possible. He has seen me through this extremely difficult yet rewarding journey.

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CHAPTER I:

INTRODUCTION

The condition of science education in the United States is in serious crisis (Wenglinsky & Silverstein, 2007). Over the last half century, efforts have been made to improve science learning and teaching in U.S. public schools through various reform mandates. From the 1957 launching of Sputnik until the publication of *A Nation at Risk* (U.S. Department of Education, 1983), an enormous amount of reform efforts have been incorporated that have focused attention on classrooms and how teachers could improve their instructional practices (Schneider, Krajcik, & Blumenfeld, 2005). The alarm was sounded loud and clear shortly after publication, and local and state leaders responded by initiating efforts that focused on standards, testing, and accountability.

According to the reports in *A Nation at Risk*, 13% of 17-years-olds were considered to be functionally illiterate and something had to be done to alter our failing future. By 2005, nearly 65% of high school students were taking recommended course work based upon graduation requirements. Although positive strides have been made, there was still a tremendous uphill journey ahead (U.S. Department of Education, 2008). At the close of 2008, the U.S. Department of Education released a follow-up report to *A Nation at Risk*. This report revealed that because of the rapid increase in our ever-changing global economy, greater demands were placed on the educational systems to educate children at a higher level than before. The unfortunate downfall

to this problem was that Americans were having a difficult time keeping up with the increasing demands set forth (U.S. Department of Education, 2008).

The following is a brief introduction to an intersecting problem between student achievement and teacher performance of extensive concern in science education. Unfortunately, students were not showing significant gains in science learning. International (TIMSS, 2007) and national (NAEP, 2009) achievement tests persistently indicated problematic outcomes in terms of science learning in the U.S. Tests results persistently disclosed declining student performance in the areas of science and math education. Furthermore, at the secondary level, dropout rates were also problematic, suggesting that adjustments must be made at the state and local levels to increase student retention. According to the Educational Testing Services (ETS) (2005), one-third of the nation's students were leaving high school without securing a diploma. Those students who were failing to complete high school ranged from inner cities to rural areas, particularly in southern states. Unfortunately, not much was being done to reverse the current crisis. According to the ETS (2005), it was possible that the only method for rectifying the problem and increasing student achievement would be to start reforming at an early age. This would create higher achievers and would lead to fewer students dropping out of high school (ETS, 2005).

Dramatic changes in the educational system were a part of an ongoing process that many states were vigorously engaged in (Wei, Andree, & Darling-Hammond, 2009). These changes were geared as a result of the poor performances of U.S. students as reported by the *National Assessment of Educational Progress* on assessments such as *Trends in Mathematics and Science Study (TIMSS).* The reports revealed that U.S. students fell significantly behind students in other countries (National Center for Education Statistics [NCES], 2000). In addition, as a result of the

release of the *No Child Left Behind Act*, reform efforts had been heightened. This implementation placed huge accountability measures on classroom teachers by mandating that they be held responsible for student achievement based on standardized test scores (Wood, Lawrenz, Huffman, & Schultz, 2006).

According to the standards set by the *No Child Left Behind Act*, all students must be at 100 percent proficiency in testing assessment by 2014 (Alabama State Department of Education, 2011). In an effort to raise student achievement in science and at the same time alter the way science was taught, higher standards for science teaching reforms were set by national, state and local agencies (Darling-Hammond & Richardson, 2009). Given that student learning is reflective of teaching practices in classrooms, it is imperative that we find ways to support teachers' professional development opportunities (Wei et al., 2009). For example, Schneider, Krajcik and Blumenfeld (2005) conducted a research study to describe teachers' enactments in comparison to reform as instantiated in reform-based science materials. The initial enactment of an inquiry-based science unit on force and motion of four middle school teachers was analyzed. The findings from this study indicated that two of the four teachers' enactments were consistent with intentions, whereas, the other two teachers were not. Overall, findings suggested that using materials that are specific in detail, consistent support for teacher thinking can help teachers with enactment. Materials alone will not suffice; reform efforts must include professional development that creates systemic change that supports teacher learning.

What do we know about professional development programs and their impact on teacher learning (Borko, 2004)? Effective professional development, according to Chappuis et al. (2009), is an experience that is supposed to foster lasting change in the classroom. Certifying the success rate of students requires innovative ideas by teachers who can respond to the needs of

their students and create strong connections between students' experiences and the goals of the curriculum (Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009). By examining the information about the nature of professional development throughout the U.S., policy makers and education leaders can start the evaluation process of how teachers' learning could be further supported (Darling-Hammond et al., 2009). However, after decades of research a quality of excellent professional development remains elusive. According to Joyce (2009), approaches to professional development have not been accompanied by programmatic research which leaves educational leaders with insignificant information to guide policy and practice.

Statement of the Problem

With the 2001 mandate of *No Child Left Behind Act*, increased levels of accountability were being placed on teachers and their role in student achievement. As a result of this mandate, teachers were seeking professional development that would help alter their instructional practices (Wheeler, 2007). From year to year, teachers were required by state and federal laws to attend professional development trainings as a part of continuing education credits. Unfortunately, teachers were often disillusioned because most of the professional development that they receive was inadequate (Chappuis, Chappuis, & Stiggins, 2009; Borko, 2004). Teachers found that professional development that was collaborative in approach, extensive, ongoing, and connected to practice (Darling-Hammond et al., 2009) was most useful for instructional practices and student achievement. In addition, Wheeler (2007) revealed that teachers desired to attend workshops that built upon content knowledge.

Purpose of the Study

The Alabama Science in Motion (ASIM) Initiative is a state-generated program that was used to increase hands-on instruction and was utilized as a tool to aide in increasing student

achievement. With this in mind, the purpose of this study was to investigate biology teachers, chemistry teachers, and facilitators' perceptions of the ASIM professional development experience in regards to the impact, if any, it had on secondary science classroom-teachers' instructional practices. In addition, this study revealed what teachers and facilitators perceived as strengths and limitations of the ASIM professional development overall experience.

Research Questions

1. How did biology teachers, chemistry teachers and ASIM facilitators perceive the Alabama Science in Motion professional development experience; and
2. What did the teachers and facilitators perceive as strengths and limitations of the Alabama Science in Motion professional development experience?

Null Hypothesis

There is no statistically significant relationship between biology/chemistry teachers' perceptions of the quality of the ASIM training and implementation of the ASIM Modules into classroom instruction.

Significance of the Study

The proposed study was significant to current discussions, policies, and practices regarding professional development. It was important in reforming and restructuring science education. Supporting teachers by offering the opportunity to attend meaningful professional development, according to Darling-Hammond et al. (2009), is how this restructuring will occur. This study provided information for those responsible for the implementation of effective professional development experiences. Moreover, the results could be utilized to enhance or make changes to the implementations of future ASIM professional development experiences and possibly encourage the increase in funds to keep this training active. The information from this

study could possibly be used by school systems to encourage teachers who are normally reluctant in attending traditional professional development trainings to attend the ASIM experience. The information gathered from this study can be used as a means of exposing knowledge that can encourage state and local governments to continue funding ASIM experience that teachers encounter. Finally, central office staff, high school curriculum specialists and administrators can analyze the results of this study and use them as indicators for future use in improving within their school districts.

Definition of Terms

Alabama Science in Motion. An initiative that is now a national model for secondary science outreach programs developed by the Alabama State Department of Education to improve science education by training teachers with hands-on lab activities throughout the state of Alabama. It is an alliance between Universities and high school science classrooms (Alabama State Department of Education, 2009).

ASIM Master Site. Alabama Science Education Resource Sites that supplied the professional development science modules, the materials refurbishment center and science specialist for each of the ASIM in-service districts (Alabama State Department of Education, 2009).

ASIM Modules. Kits containing teacher's manuals, student labs, and all the necessary materials for the teachers and students to work through the investigations and hands-on science lessons (Alabama State Department of Education, 2009).

ASIM Institute. Two consecutive weeks of professional development where teachers were guided through lessons from the science curriculum using the manipulatives in the kit provided for their classroom instructions (Alabama State Department of Education, 2009).

Hands-on Science. Students using scientific manipulatives in the classroom to learn specific science objectives (National Research Council, 1996).

Inquiry-based Science. Science that occurred when students asked questions, planned investigations, collected, organized and analyzed data (National Research Council, 1996).

Professional Development. The process of improving staff methodologies and competencies needed to produce exceptional educational results for students (Hassel, 1999).

Limitations

The following restrictions were imposed on this study:

1. All teacher participants were high school biology teachers and chemistry teachers from one geographical area in North Alabama that may not have revealed a true depiction of the ASIM professional development training;

2. The researcher solicited more in-depth responses from only two trainer participants that may or may not give a true depiction of the ASIM training; and

3. This study was limited to a portion of teachers who completed at least one summer of the ASIM training at Alabama A&M University or The University of Alabama Huntsville master site.

Assumptions

It was assumed that all the teachers and facilitators who take part in this research study did so with honest and thoughtful responses. It was further assumed that all participants would continue to take part until the study was fully completed. Additionally, it was assumed that the perceptions solicited from teachers and facilitators who participated in this study were valued by the Alabama State Department of Education.

Summary

This research study consisted of a five chapter series. The first chapter included the introduction to science education and reform in regards to this study. In Chapter II, review of past and present literature was discussed in reference to science education reform, professional development and teacher instructional practices through the ASIM hands-on learning workshop. Chapter III gave detailed information on how the study was conducted and its methodologies. After the study was conducted, Chapter IV was utilized to present the results. Finally, in Chapter V, further discussion of the findings, including interpretations and implications, were addressed.

CHAPTER II:

REVIEW OF THE LITERATURE

This study examined what makes ASIM (Alabama Science in Motion) professional development a viable training program and explored high school biology and chemistry teachers and ASIM trainer's perceptions of this professional development training. The purpose of this study was to investigate perceptions of high school biology teachers and chemistry teachers in respect to the implementation of the Alabama Science in Motion professional development training in the school where biology and chemistry was taught.

Science Education Reform

Science teachers throughout the United States are confronted with the pressures of accountability through the demands of the 2001 mandate of *No Child Left Behind* (NCLB). Even at the state and local levels, reform efforts have been implemented. Alabama has employed several initiatives as a response to the critical need for science education reform. The reform efforts initiated will hopefully ensure the scientific and technological literacy of all students. A culmination of groups at the local, state and government levels have been vigorously working toward reforming Alabama through four reform initiatives that are focused on the implementation of inquiry-based science through the use of exemplary curricula (Alabama State Department of Education, 2008). The four initiatives are 1) Alabama Laser; 2) Alabama Hands-On Activity Science Program (AlaHASP); 3) Hands-On Activity Science Program (HASP); and 4) Alabama Math, Science and Technology Initiative (AMSTI).

Science education is currently going through a rigorous process of redeveloping educational efforts throughout the nation (Geier et al., 2008; VanDriel, Beiguard, & Verloop,

2001). National, state, and local agencies have been working on the adoption of reform programs since the publication of *A Nation at Risk* (National Commission on Excellence in Education, 1983) and before. This report stated that there was a grave need for systematic reform efforts throughout the U.S. The aim of these efforts is to raise student achievement by setting higher standards. Similarly, reform efforts have placed attentive measures on the classroom and the way teachers can improve their instructional practices. According to Selden and Selden (1997), teachers have the tendency to teach their students the way they were taught. More so, Sungur and Tekkaya (2006) stressed that in a technologically advanced era, traditional teaching methods are a thing of the past and have been shown to be ineffective. Because of the traditional methods of teaching, students are having extreme difficulties remaining motivated about learning, which results in low levels of comprehension and increasingly high dropout rate (Sungur & Tekkaya, 2006).

Poor levels of performance on international measures of achievement such as the *Third International Math and Science Study* (TIMSS) have been the driving forces for many reform efforts (NCES, 2000). Schneider and colleagues (2005) have asserted that in an effort to assist teachers in making changes that are consistent with recent reform efforts, extensive professional development programs have been put into place. In an analysis of current professional development efforts, Suporitz and Turner (2000) concluded that high quality professional development has a direct effect on student achievement. More so, Suporitz and Turner (2000) stressed that repeated participation in quality workshops will produce superior classroom teaching and increase student achievement.

Advancements in the areas of science are ways of empowering overall teaching and learning in public schools. For many years there have been a number of demands for science

education reform that solicits professional development as a core means of improving science education (AAAS, 2009; NCMST, 2000; NSES, 1996). There is a tremendous need for professional development considering the huge number of science and mathematics educators who teach outside of their content area and who enter the profession on an emergency basis (National Commission on Teaching and America's Future (NCMST), 1996).

Schneider, Krajcik, and Blumenfeld (2005) suggested that visible changes in professional development and effective student learning have to be supported by material that is suitable for learning and must also be consistent with reform efforts. The utilization of material alone, however, will not promote the needed changes in reform efforts. Teachers must be reflective in their teaching practices and attempt to translate material into practice in their classrooms (Schneider et al., 2005). In addition, Ball and Cohen (1996) proposed that the design of curriculum material offer teachers overwhelming support that will enhance teaching while the instructional material play a vital role in fostering student learning.

Many reform efforts have been implemented during the 21st century. Past and present research supports the many attempts at reforming education (Heller, Daehler, & Shinohara, 2003; Wheeler, 2007; Wenglinsky & Silverstein, 2007; Wei et al., 2009). For example, Johnson, Kahle, and Fargo (2007) conducted a longitudinal study that consisted of middle school science teachers to explore the relationship, if any, between teacher participation in whole school, collaborative professional development and student achievement in science. Teachers went through a two-week summer institute followed by monthly professional development sessions on implementing instruction outlined by the National Science Education Standards. Student achievement was assessed in grades 6-8 and the findings revealed the positive impact that whole-school; sustained, collaborative professional development has on overall student achievement.

The indication was that programs as such could be a means of narrowing achievement gaps in the areas of science. Darling-Hammond (1996) and Yager (1992) noted that teachers are central to the success of science reform efforts. With this in mind, it is the belief of researchers that reform begins with effective professional development.

Professional Development

A number of descriptions of professional development have emerged during the last decade or so as generic guides for teacher change processes (Fullan, 2001). Some identified the many complexities in the changes that are made during teacher professional development. For example, Hargreaves and Fullan (2001) viewed teacher development as knowledge and skill development, as development in self-understanding, and also as social change. In this way, they highlighted the influential and determining dimensions of the person, the social group, and the context in the process of teacher change. Others, such as Joyce and Showers (1998) agreed and suggested that professional development is most effective when it is looked at in terms of individual needs, the needs of schools and systems, the particular learning programs in place; and the students, their needs, abilities and characteristics.

Current research has suggested that science education reform starts with professional development (Chappuis, Chappuis, & Stiggins, 2009). Nations all around the world searching for ways to improve their education systems are doing so by investing in teacher learning as the main avenue for academic success (Wei, Andree, & Darling-Hammond, 2009). Professional development in education, according to Ingvarson, Beavis, Meiers (2005), has been identified as a critical element to the enhancement of teaching and learning within our schools. One aspect of professional development, according to Elmore (1996), is to encourage the improvement of science and mathematics education. Research recommends that educational systems refer to

student assessment as a key measure to the determination of professional development needs (Holloway, 2003). In addition, teachers are urged to use the instructional practices learned through professional development towards the needs of the individual student learning styles.

Since professional development, as described by Hassel (1999), is a process utilized to improve teacher competency levels, effective implementation should increase student achievement. Vontz and Leming (2006) echoed this by defining professional development as a structured way to enhance student learning through improved teaching strategies. Garet, Porter, Desimone, Birman, and Suk Yoon (2001) placed emphasis on the fact that most teachers believe that effective professional development opportunities will result in positive changes in student performance. Furthermore, professional development needs to be more pedagogical in nature and guided by well-defined content standards (Hassel, 1999). Research conducted by Garet et al. (2001) and Hassel (1999) stressed the importance of ongoing professional development and how it is more beneficial for teachers than professional development trainings that are short and vague in nature.

Although professional development programs may take many forms and follow many processes, the *No Child Left Behind Act* (2001) requires that professional development support "best teaching practices," which translates into improved student learning. NCLB further specifies the use of research-based content for professional development to increase the probability that professional development programs will result in increased student learning outcomes (U.S. Department of Education, 2003).

Shulman (1987) recommended that teacher education, including professional development, help teachers to think and reason about their teaching practices. He pointed out that it is the content knowledge and the pedagogical knowledge that holds real challenges for teachers

who must learn about an innovation and somehow convert their new knowledge into a pedagogical form. As assessed in Darling-Hammond and Richardson (2009), professional development that places center attention on students and assisting teachers develops pedagogical skills to teach specified content, has a positive effect on instructional practice.

Focusing upon specific elements that encourage and supports teacher change is Guskey's (1986) model of effective staff development. This model suggested that teacher change will occur through staff development programs that encourage teachers to alter their classroom practice and improve student learning outcomes. The different models of professional development often contain isolated key characteristics, which together are combined to describe quality professional development programs (Guskey, 1986). Joyce and Showers (1988) asserted that a number of underlying characteristics have been identified across all of these models and descriptions. The t-chart in Table 1 lists characteristics of professional development trainings. The chart displays the differences between typical teacher training and that of inquiry teacher training. It also displays the characteristics that are common to many professional development models.

Table 1

Characteristics Common to Professional Development Models (Joyce & Showers, 1998)

Typical Teacher Training	Inquiry Teacher Training
Short-term, one day sessions	On-going, continuous
Seminars, conference sessions, workshops, and lectures	Inquiry projects, hands-on learning
Presenter, discuss ways to improve learning	Facilitator, guide and coach student learning
Individual learning activities	Collaborative learning activities
Theoretical Research Approach	Cognitive Research Approach
Teacher demonstration, acquiring techniques	Strong emphasis of reflection and follow-up

First, it has been recognized that in planning for professional development, teachers' existing beliefs and knowledge must be taken into account, as these will influence the perspective the teachers take of an innovation and the sense they make of that innovation (Joyce & Showers, 1998). Second, non-critical assistance and support can be invaluable for facilitating teachers' review and reflection upon their own practices and beliefs (Joyce & Showers, 1998). Third, opportunities to engage in professional dialogue with colleagues in similar situations, facing similar challenges, can provide encouragement, support, and critical friendships (Joyce & Showers, 1998). Fourth, teachers need to feel a sense of responsibility for their own learning and development (Joyce & Showers, 1998). Finally, time, space, and opportunity are needed for teachers to experiment with ideas and to reflect upon their experiences (Joyce & Showers, 1998).

The power of training to alter teachers' knowledge, attitudes, and instructional skills has been well established. Its impact on teachers, however, depends upon objectives and the quality of the training program. Joyce and Showers (1998) have determined that when all training components are present (theory, demonstration, practice, feedback, and coaching), an effect size of 2.71 exists for knowledge-level objectives, 1.25 for skill- level objectives, and 1.68 for transfer of training to the classroom. (The effect size describes the magnitude of gains from any given change in educational practice; the higher the effect size, the greater the magnitude of gain. For instance, an effect size of 1.0 indicates that the average teacher in the experimental group outperformed 84% of the teachers in the control group).

Although these data indicated that teachers are able to acquire new knowledge and skill and use it in their instructional practice when provided with adequate opportunities to learn, Joyce and Showers (2002) redefined their model of professional development. After reviewing the research on training efficacy, the authors eliminated feedback and added peer coaching. They argued that for teachers to become effective learners, they need specific attitudes and skills, including persistence, understanding of the transfer of training, understanding of the need for theory and the ability to use peers productively. In addition, peer coaching not only contributes to the transfer of training; it also facilitates the development of new school norms of collegiality and experimentation (Joyce & Showers, 2002).

Research revealed a visible connection between professional development and student achievement (Wenglinsky & Silverstein, 2007). Studying the link between the two is a complex situation that is costly for many school districts (Wei et al., 2009). Furthermore, the impact of professional development on student achievement is also very limited (Resnick, 2005). Although limitations exist, Mizel (2003) believes that in order for schools to educate all students to

enhanced levels, educators must assume that professional development is a constructive approach that embarks on engaging educators in learning experiences with individualized benefits to students. As educators have a chance to analyze the effects of staff development on students, the learning process for adults continues. Mizel (2003) revealed that if training is apparently linked to improved student learning then school leaders and teachers typically place greater value on staff development. Research suggested that change in the classroom practices of teachers, change in teacher attitudes and beliefs, and change in the learning outcomes of students are three major goals of professional development programs (Guskey, 2002).

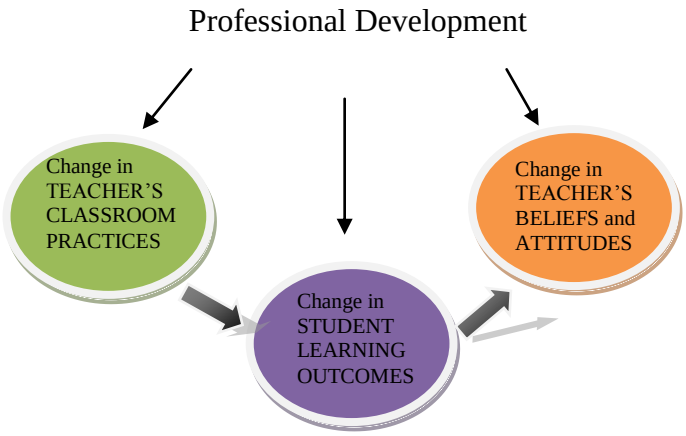

Figure 1. A Model of Teacher Change (Guskey, 2002)

Based on research conducted by Schmoker (2002), schools should design professional development to directly affect student learning by having teachers work in teams despite socioeconomic challenges. The focal point of each team should first be to design and assess instructional strategies to target standards students are failing to meet. In addition, the team should review achievement data to target learning gaps and focus on assessed standards. In order to improve classroom practices, Sanborn (2002) believes that professional development training should be data driven.

In a study conducted by Dougherty (1998), one district utilized student performance as a means of tracking student progress while the district implemented innovative approaches and practices. This course of action became a way for school leaders and teachers to scrutinize school reform efforts. The district had the ability to minimize the achievement gap by seeking confirmation of learning and creating ways to address gaps in learning. The study consisted of two groups, one white and the other Latino. As the scores of the groups increased, the percentage points between the two on the state reading assessment in the 3rd to the 8th grade narrowed. In 1992-1993, the average points were 27 compared to an average of three points in 1997-1998.

In a different study, Danna (2004) also found that professional development must be driven by statistical data teachers need continuous time to engage in staff development to create a difference in student achievement. Data retrieved from Glens Falls City School determined areas of needed improvement based upon three years of state assessments. School leaders realized that appropriate funding and altering the school calendar was utterly necessary to accomplish this task. Teachers begin to integrate the new information into their methods of teaching and therefore developed a clear understanding for the need of data. Soon after, teachers began to work collaboratively on what specifically should be taught and the areas of struggles that were displayed through student work samples. Mahan (2003) respectfully noted that teachers who work in a team effort yielded much more effective in professional development results. With positive feedback from other teachers, improvements in teaching increased.

Chappuis, Chappius, and Stiggins (2009) emphasized that when it comes to professional development and student achievement, much of the pressure to meet the goals that are set falls upon the teachers. Visible changes in classroom practices will require learning on the part of the teacher and will be difficult to visualize without guidance and support (Putman & Borko, 1997;

Wilson & Berne, 1999). Correspondingly, Black and Williams (1998) have maintained that the prime focus for raising standards along with student achievement is directly related to classroom practice.

Several structures of school improvement according to (Darling-Hammond & McLaughlin, 1995; Garet et al., 2001; Guskey & Sparks, 1991; Joyce & Showers, 2002) must be present if staff development is to notably affect student learning. Based upon these research findings, five distinguished characteristics were revealed to support effective professional development. The characteristics that support professional development including the following: 1) content and pedagogical knowledge; 2) duration; 3) collective participation; 4) follow-up; and 5) available resources. The use of the attributes listed would have a positive impact on teaching and learning based on research findings (Darling-Hammond & McLaughlin, 1995; Garet et al., 2001; Guskey & Sparks, 1991; Joyce & Showers, 2002).

Content and Pedagogical Knowledge

Content and pedagogical knowledge are vital to the success of effective educational change. Pedagogical knowledge is knowledge of learning methods and of teaching (Barnett & Hodson, 2001). It includes skills, personal beliefs, and images about teaching and learning (Grossman, 1990). High quality professional development should focus on specific pedagogical content knowledge. Because high quality professional development is a growth process, the implementation will most likely lead to increased student learning (Haslam & Serement, 2001). Teachers must possess specific content knowledge that supports the ability to understand student misconceptions, deliver content on various learning styles and know ways to solicit student engagement (Shulman, 1986). Furthermore, the content specific knowledge that teachers gain through professional development is what is transformed into instruction. With this in mind,

Shulman (1986) stated that teachers need the chance to engage in learning that aids in the expansion of content knowledge.

While content knowledge is important for teachers in any professional development program, according to Basista and Mathews (2002), pedagogical content knowledge must be taken into account as well. The goal of professional development should be to assist teachers in ways to enhance learning within the classroom. Teachers should be guided on ways to recognize if students are grasping what is being taught. Content knowledge alone does not ensure that teachers are giving students what is adequately needed to be efficient in the classroom (Basista & Mathews, 2002).

Johnson (2006) conducted a qualitative case study that explored barriers that seven science teachers faced who participated in a professional development experience. This professional development training was designed to prepare them for the implementation of standard based instructions. Data collection was based upon classroom observations and teacher interviews. The results of this study revealed that the lack of content pedagogical knowledge constituted as a barrier for reform through change in practice. The meaning behind science and mathematics reform is that teachers must use new knowledge and beliefs as ways of altering instructional practices in the classroom. According to Darling-Hammond and McLaughlin (1995), new knowledge can be the result of professional development that affords teachers with what is desirable to sustain successful student learning.

Supovitz and Turner (2000) disclosed that teachers' content knowledge has a drastic effect on the culture of the classroom and on some teaching practices. Anderson (2002) argued that lacking content or pedagogical knowledge makes it difficult for teachers to implement new instructional strategies. Having strong content and pedagogical knowledge means that reform

efforts have a greater chance of being successful (Anderson, 2002). According to Darling-Hammond (1997), teachers are under vast amounts of stress simply because they are not trained on how to teach effectively.

Duration

Many school districts have begun to streamline the academic calendar year to allow time for more effective professional development (Wei et al., 2009). Educational leaders point out that arbitrary acts of professional development do not assure effective school improvement**.** The amount of time devoted to professional development activities that have been conducted, was identified as a key issue with professional development efforts (Wei et al., 2009). The National Science Education Standards (NRC, 1996) calls for extended and articulate professional development plans. Teachers participating in short-term workshops are not given the opportunity to become more in-depth with the teaching strategies presented. One-time professional development experiences, according to Putman and Borko (2000) and Joyce and Showers (2002), are not considered as being effective and will not change teaching practices. More so, it does not allow teachers the opportunity to construct content knowledge (Loucks-Horsley & Matsumoto, 1999).

Based on this assertion, Supovitz, Mayer, and Kahle (2000) conducted a longitudinal study that examined the impact of professional development on the attitudes of teachers toward inquiry-based instruction. At the completion of the study, the teachers used the information learned from the training in their classroom instructions. Implementation of these strategies caused a change in student learning. The results of this study disclosed that continued experiences of professional development training led to adjustments in the teacher's instructional practices.

Data collection in the form of surveys, interviews, observations and reflective writing exercises were taken from 93 secondary teachers and nine administrators. Results from the study yielded results that they were extremely concerned with time management. The teachers came to the conclusion that because of the large amount of information gathered during the one-day professional development training, it was deemed ineffective. Programs that were at least 80 hours in length were successful in teacher changes as established by Basista and Mathews (2002) in comparison to those that were less.

Collective Participation

An additional quality that supports effective professional development is collective participation among teachers (Darling-Hammond & McLaughlin, 1995; Garet et al., 2001; Guskey & Sparks, 1991; Joyce & Showers, 2002). Professional development is strongly influenced by the willingness of teachers within a department or school to work together (Darling-Hammond et al., 2009). Vertical teaming as noted by Vontz and Leming (2006) also lends a positive effect on continuous professional development. Garet et al. (2001) affirmed that the collaboration among teachers from similar settings can improve content knowledge and promote educational maturity. Long term positive results are more likely when shared professional development is experienced. Unsuccessful implementation is likely if there is a decline in an ongoing commitment to collective professional development (Basista et al., 2001; Klinger et al., 2003; Sydow, 2000).

Huffman and Thomas (2003) examined professional development experiences at 46 schools that consisted of 94 middle-school science teachers and 104 middle-school mathematics teachers. It was revealed that although professional development is publicized as the solution to science and mathematics education reform, professional development is not merely enough.

Fullan (2001) attest that collaboration has great power and only alters learning when the focus is directly related to student performance for all.

Follow-up

Most teachers are more than willing to being an active participate in professional development trainings (Bullough, Burbank, Gess-Newsome, Kauchak, & Kennedy, 1998), however, some has reservations. In fact, most are opposed if there is little to no evidence of any type of professional development follow-up. According to Bullough, Burbank, Gess-Newsome, Kauchak, and Kennedy (1998), professional development training administered to teachers is outdated and lack follow-up that would guarantee proper implementation. As emphasized by Darling-Hammond and McLaughlin (1995), teachers thrive from effective follow-up activities where they are modeling and collectively solving specific problems. Follow-up activities are also contributing factors for long-term impact in classroom learning (Marshall, Pritchard, & Gunderson, 2001).

A three-to-four week training, including follow-up activities during the school year, was funded by the Eisenhower Professional Development Program and National Science Foundation (NSF) Project each explored the practices and opinions of teachers. The collection of survey data administered to 33 participants after one year of training revealed that there was an increase in both abilities and confidence. Because of the follow-up activity, teachers were more capable of implementing learned practices within their classrooms. Not only were they able to implement learned practices, Basista et al. (2001) noted that teachers were able to obtain better content knowledge that would aide in that implementation.

The final attribute of effective professional development is determined by the availability of resources. With recent budget cuts, teachers are scrambling now more than ever for ways to

get the needed professional development to enhance classroom instruction. Brown and Smith (1997) stressed that the availability of teacher instruction provides focus on student learning and is necessary for a successful program. A study conducted by the National Research Council (1999) found that the more money that was spent on the development of teachers, the greater the student achievement.

In summary, professional development is about developing powerful learning habits that are used daily to increase teacher and student learning (Fullan, 2001). Without the development of habits, most professional development trainings fail to impact teacher practices. Lester (2003) pointed out that organized and planned professional development training assists teachers in constructing habits to enhance classroom learning. Research supports the idea that for professional development to be beneficial, it most likely needs to be structured and have purpose that has well defined goals for improving student achievement.

Inquiry Science Teaching

The process of preparing individuals to be scientifically literate has gained much attention in science education literature (Yacoubian & BouJaoude, 2010). With this in mind, experts suggest that teachers incorporate ways in which to involve students in hands-on-learning (Yacoubian & BouJaoude, 2010). This type of learning is often thought of as inquiry learning. Learning science through the inquiry method is often described as activities in which students engage in when doing science (German, Haskins, & Aduls, 1996). This could be the missing piece of the puzzle in the efforts of educational reform (Smolleck & Yoder, 2008).

The process of teaching students to think can be accomplished by utilizing the inquiry method. In fact, educational experts recognize that reworking the way students are taught depends on the dedication from teachers. As noted (Marx & Harris, 2006; National Research Council, 1996,

2000), the teacher acts as a facilitator who constructs learning conditions while the students are actively engaged in experiments with their peers. According to Anderson (1997) and Darling-Hammond (1996), promoting deep understanding of science is more effectively seen through student-centered instruction.

Taraban, Box, Myers, Pollard and Bowen (2007) conducted a study with active-learning labs. The study consisted of 408 high school students. The teachers kept detailed records describing daily classroom activities. Instruction was administered to the students in either a traditional teaching method or an inquiry method. The teacher's records indicated that they used less independent work and more collaborative lab activities. The results of the study showed that students gained significantly more content knowledge and knowledge of process skills utilizing lab exercises versus traditional instruction. In addition, the results of an independent questionnaire given to the teachers revealed that the use of lab-based curricula altered their behaviors to resemble a more student-centered principle of teaching.

In a similar study with a group of junior high students in Taiwan, Chang and Mao (1999) taught one group using inquiry based instruction and the other using traditional teaching methods. This was a comparative study that consisted of sixteen classes. Of the sixteen classes, 293 students were administered traditional teaching instructions where 319 were taught with inquiry instructions. A multivariate analysis of covariance revealed that the students who were taught using inquiry instruction scored significantly higher on the Earth Science Achievement Test than those under traditional teaching instructions. The attitudes of the students showed that they favored inquiry instruction over traditional instruction. More so, greater classroom interaction and an increase in confidence level were displayed by the students who were taught using the inquiry method instruction. Broadly speaking, researchers believe that allowing

students the insight to gather and interpret their own data increases comprehension (Chang & Mao, 1999). Having the opportunity to work cooperatively in groups, allowed students to learn from each other. Finally, students in inquiry group instructions planned their own lab experiments and then shared their findings with their fellow classmates.

In a different study, Schneider, Krajcik, Marx, and Soloway (2002), conducted a study to investigate student performances on the National Assessment of Educational Progress (NAEP). The study was conducted by utilizing a group of 142 tenth and eleventh grade high school students. The students were taught using project-based science (PBS) and were compared to similar students. The PBS students outscored other students on the national sample on NAEP. The PBS students scored higher on most of the scientific investigation questions as well. Additionally, students who were not taught by PBS were out scored on 44% of the NAEP test items by those who were taught by PBS instruction.

Robinson (2005) utilized case studies to compare three groups of students studying eighth grade physics using robotics in the place of traditional lab materials. Robolab was used by the robotics team for the robotic-driven activities. The three teachers represented a regular class with many English language learner students and a mathematics, engineering, science achievement class of afterschool volunteer students. The teachers answered nine questions on how robotics addressed the middle school physics standards, how it promoted inquiry learning and science literacy in students, how it provided scaffolding for more discussion of everyday English and science academic language, and how it made a connection between science and everyday life. In conclusion, it was reported that teaching with robotics promoted inquiry, made physics more interesting, and helped students enhance their vocabulary.

Traditionally, the process of students asking questions and developing procedures involves classroom inquiry (Olson & Loucks-Horsley, 2000). The purpose of inquiry based instruction is to provide students with the learning experiences needed to develop scientific knowledge in the context of scientific processes (Yacoubian & BouJaoude, 2010). Inquiry is a fundamental element of the restructuring of science education as well as the key argument within the framework of educational reform (Smolleck & Yoder, 2008).

Overview of ASIM

Alabama Science in Motion (ASIM) is the high school component of Alabama Math Science and Technology Initiative (AMSTI). The ASIM training is a program funded by through the State of Alabama that was created to train science teachers in inquiry learning. The program originally started at Juniata College in Huntingdon, Pennsylvania in 1986. Original funding for the ASIM program was through the National Science Foundation. The program posed such a strong impact, seven years later; Alabama decided to launch their own professional development training (Alabama State Department of Education, 2010).

The goal of ASIM experience is to provide high-tech laboratory experiences for students and effective professional development for teachers. This is a professional development workshop that aims to provide teachers with an elevated mastery of subject matter and equipment use. ASIM provides high school teachers with research-grade equipment, inquiry-based discipline training and classroom support needed to run effective science laboratory programs. Likewise the program is designed to empower teachers with materials and knowledge that can be incorporated into their everyday lessons (Alabama State Department of Education, 2010).

ASIM incorporates a teacher-training component that is conducted for two consecutive weeks with five additional days during the school year. Summer training is designed to update and strengthen content knowledge, to familiarize teachers with the use and operation of ASIM equipment, and to model teaching strategies that are successful with students of various learning styles and levels. Teachers must attend follow-up workshops during the school year that allows them teachers to "perfect" their knowledge and to share suggestions and experiences from the classroom (Alabama State Department of Education, 2010).

Each summer workshop experience is conducted under the direction of a master teacher at a master site. The role of the master teacher is to oversee all aspects of the ASIM program. This ranges from budgeting, purchase supply, recruitment, training, to curriculum development. The designated facilitator is responsible for the delivery of ASIM modules and available to assist teachers with classroom lab exercises. Initially, the ASIM facilitator discusses and leads the laboratory activity until the teacher feels comfortable. The ultimate objective is for the teacher to lead the lab, or for the ASIM Specialist and teacher to team-teach the lab (Alabama State Department of Education, 2010).

The high school teachers, who decide to participate in this rigorous two week program, must complete 16 labs that correspond to the standards of the *Alabama Course of Study.* The training also includes lab safety training for both first and second year teachers. Teachers with experience are often solicited to assist with requirements of the ASIM experience. Each teacher participant receives a $50 stipend per day of training, mileage and per diem expenses (Alabama State Department of Education, 2010).

Teachers attend class each day from 8:00am - 3:00pm with breaks and lunch in between during the ten days in the summer. Lab exercises are introduced by the facilitator (master teacher) and carried out by the attending teachers. Teachers work in pairs as most of their students will during classroom instruction. Teachers will also have an opportunity to ask questions and share knowledge with their fellow colleagues (Alabama State Department of Education, 2010).

At the completion of training, teachers may borrow ASIM modules and/or equipment on a first-come, first-serve basis. Labs are prepared by the master teacher and delivered to the school site. Teachers have a set number of days in which to utilize the modules for classroom instruction. Because master teachers are certified in their area, they are available to teach lab activities as well (Alabama State Department of Education, 2010).

The lab kits are pre-packaged with equipment, consumables, and instructions for 24 students in a large plastic box. Each kit is set up for not only individual use but small cooperative group work as well. Each kit is also accompanied by worksheets that give step-by-step directions on how to complete the activity (Alabama State Department of Education, 2010).

CHAPTER III:

RESEARCH DESIGN AND METHODOLOGY

Introduction

The specific purpose of this study was to investigate biology and chemistry teachers' and facilitators' perceptions of the ASIM professional development experience in regards to the impact, if any, it had on secondary classroom teachers' instructional practices. Furthermore, this study was conducted to determine teachers and facilitators' perceptions as to the strengths and limitations of the ASIM professional development experience.

This chapter revolved around the methodology and design of the research and described in detail the study population. A breakdown of the demographic information of participants was included within this chapter. The development of the survey and focus group instrument was described and efforts to ensure validity and reliability were discussed, including the process of how the adapted survey was to be field tested to fit the study on the ASIM experience. Data collection procedures with timelines were also presented. Finally, this chapter was concluded with the description of analysis of data. The final survey questionnaire and focus group questions were included in the Appendix B and C.

The research questions that were explored included the following: 1) how do biology teachers, chemistry teachers and facilitators perceive the Alabama Science in Motion professional development experience; and 2) what do the teachers and facilitators perceive as strengths and limitations of the Alabama Science in Motion professional development experience? The term professional development refers to the process of improving staff

methodologies and competencies needed to produce exceptional educational results for students (Hassel, 1999).

Research Design

This research study was conducted and analyzed using a mixed method of numerical and descriptive research. The use of qualitative research, according to Strauss and Corbin (1990), is data collected by the researcher that does not consist of numerical data. Qualitative research is the type of research that depends on how much effort and ability is contributed by the actual researcher. In fact, Merriam (1998) stated that the researcher seeks to make sense of a person's interpretation and their worldly experiences. Additionally, the acquisition of qualitative research is for the understanding of the occurrences being studied (Creswell, 1998).

According to Creswell (1998), when conducting qualitative research the research question often begins with a "what" or a "how" as to gain a full description of the events. More so, Creswell (1998) has stated that exploration is a factor for utilizing the qualitative approach because the variables are not easily identified during research process. Furthermore, research suggests that in qualitative research, the researcher has a receptive audience. Additionally the researcher is non-bias and has the ability to tell the story from the viewpoint of the participants.

On the other hand, quantitative research is used to study research problems requiring a description of trends or explanations of the relationship surrounding multiple variables (Creswell, 2003). According to Cooper and Schindler (2003), in order to formulate concrete and meaningful research questions that assist the researcher in what is being measured and/or tested, the independent and dependent variables must be precisely characterized. This approach ensured uniformity in measurement throughout the study.

The survey design employed for this study followed a quantitative approach that was utilized to examine the variables stated in the research questions. Surveys are often utilized to retrieve information about a person's attitude and opinion. The most appropriate application is when respondents are uniquely qualified to provide the desired information requested (Cooper & Schindler, 2003). Versatility and the ability to assess large numbers of respondents (Cooper & Schindler, 2003) are considered the greatest strengths of using surveys as a part of collecting data. The advantages of web-based surveys include reduction in time, costs, and data entry (Wright, 2005).

On the downside, the disadvantages of surveys may include potentially low response rate, loss of subjective information, and the inability to probe or gather additional explanations from participating respondents (Cooper & Schindler, 2003). The collection rate of electronic or online questionnaire responses is around 65% if the participants are specifically targeted (Wright, 2005). Online surveys as shared by Norman and Russell (2006) can be to the advantage of the researcher through the verbal participation individuals with colleagues thus, increasing the number of overall responses. Likewise, online surveys have proven to be efficient and cost effective, thereby increasing survey deployment as well as follow-up (Wright, 2005). In addition, web-based surveys eliminate the need for a traditional paper survey, thereby creating the expansion of distribution possibilities.

Participants and Setting

The participants in this study consisted of biology teachers, chemistry teachers and ASIM facilitators from North Alabama. The ASIM teacher participants were serviced by Alabama Agricultural &Mechanical University and the University of Alabama Huntsville In-service Center. Teacher participants who were a part of this study participated in the Alabama Science In

Motion Summer Institute for at least one year within the last five years, and instructed students using the ASIM modules throughout the academic year. All teachers who were included in the study taught a variety of subject areas in grades nine through twelve. The participants taught subjects outside of biology and chemistry such as physics, environmental science, human anatomy, physiology, and earth science. In addition to the ASIM biology and chemistry modules, teachers also utilized other resources that coincided with the standards, objectives and the Alabama Course of Study (ALCOS) items set by the state of Alabama.

The facilitators who were used for this study were responsible for training and facilitating teachers for a number of years. First of all, the facilitator is the major guide to the overall ASIM experience. Each facilitator is titled as a master teacher, and was housed at a master site. The role of the master teacher was to facilitate lab activities that correspond to the Alabama Course of Study. In addition, the facilitator is responsible for the delivery of the ASIM modules to schools where requested. The facilitator is also available to assist in the implementation of the lab modules.

Demographic Information of Participants

There were a total of 83 biology and chemistry teachers who participated in this study. Of the 83 participants, 59 (71%) indicated having earned their master's degree, 18 (22%) earned the bachelor's degree, and 6 (7%) earned their specialists degree (see Table 2). In regards to years of teaching experience, the majority of the participants indicated having between 6-10 years (24%) and 11-15 years (27%) as compared to the participants who taught for less than six years or more than fifteen years. Fifty-two (63%) of the teachers indicated having used the ASIM Modules between 0-5 years, whereas, 14 (17%) indicated using the ASIM Modules between 6-10 years, 13 (16%) indicated using the ASIM Modules between 11-15 years, and 3 (4%) indicated using

the ASIM Modules between 16-20 years (see Table 2). Participants were also asked to indicate the number of days they teach biology/chemistry each week. Based on the responses, the majority of the participants, 70 (85%) indicated teaching biology/chemistry five days a week compared to the participants who taught biology/chemistry less than or more than five days a week (see Table 2).

Table 2

Demographic Information of Participants

Variable	Frequency	Percentage
Highest Degree		
Educational Specialist	6	7%
Master	59	71%
Bachelor	18	22%
Total	83	100%
Years of Teaching Experience		
0-5	13	16%
6-10	20	24%
11-15	22	27%
16-20	11	13%
21-25	12	15%
26-30	3	3%
31+	2	2%
Total	83	100%
Number of Years Using ASIM Models		
0-5	52	63%
6-10	14	17%
11-15	13	16%
16-20	3	4%
Total	82	100%
Number of Days you Teach Biology/Chemistry Each Week		
0	2	3%
1	0	0%
2	0	0%
3	4	4%
4	2	3%
5	70	85%
6	1	1%
7	2	3%
8	0	0%
9	0	0%
10	1	1%
Total	82	100%

Data Collection and Instrumentation

Teachers and facilitators who had participated in the ASIM professional development experience within the last five years were asked to complete a voluntary online survey provided by surveymonkey.com. The online survey took the participants approximately 15-20 minutes to complete. The researcher adapted an existing instrument used in a 2006 study investigating teachers' perceptions and use of science education reform initiative for middle schools (Pistorius, 2006). The AMSTI Science Questionnaire had previously been validated and had a reliability coefficient of .90.

The researcher adapted the Pistorius survey because it measured teachers' perception of the Alabama Math Science and Technology Initiative (AMSTI). The AMSTI program is a program that was designed to address the professional development needs of elementary and middle school teachers in the areas of science and technology. Because ASIM is the high school component of AMSTI, the researcher desired to solicit the perceptions of high school Biology/Chemistry teachers as it relates to the impact on classroom instruction. By conducting this study, the researcher was able to add to the body of knowledge by addressing professional development needs of high school biology/chemistry teachers. More so, the researcher sought to focus on a specific area of science on a higher level of K-12.

In an effort for the researcher to establish construct validity for the current study, a panel of six expert researchers was solicited for the initial reading of the previously used survey. In addition, a pilot study was conducted with 15 teachers to further aid in the construct of validity of that instrument. Because the instrument had been adapted, it was field tested by five ASIM teachers who were not part of the study to ensure reliability and validity.

Field Test

According to Creswell (1998) and Merriam (1998), field testing is conducted as a means of identifying potential problems. Field testing is a systemic scrutiny of a questionnaire and allows the researcher to determine whether the questions are understood. The five biology and chemistry teachers used to field test the instrument utilized in this study (ASIM Biology/Chemistry Questionnaire) were from schools serviced by The University of Alabama Huntsville and Alabama A&M University master site. The teachers selected for the field test previously participated in the ASIM experience. The field test was conducted in late August 2010. The surveys were hand delivered by the researcher to the teachers who agreed to participate. The teachers were allowed time to review the survey and then offered suggested revisions. After the initial review, the questionnaire was revised accordingly by the researcher. The panel revealed that question item numbers 3, 8, 11 and 16 had to be modified for clarity. The previous questions read as follows

1. I feel I have the ability to manage the ASIM biology/chemistry modules when implementing the activities;
2. ASIM meets the needs of various learning styles;
3. ASIM is a challenge for me; and
4. The ASIM materials have been beneficial to my students' understanding of biology/chemistry.

After being revised for clarity, the new questions were as followed:

1. I feel confident in my ability to manage the ASIM biology/chemistry modules when implementing the activities;

2. The learning needs of students of various abilities can be met through ASIM biology/chemistry activities;
3. The management of the ASIM biology/chemistry modules is challenging for me; and
4. I believe that teaching with the ASIM materials has been beneficial to my students' understanding of biology/chemistry.

The questions were revised at the recommendation of the panel who felt that more clarity was needed to ensure open responses from the participants. The revisions were then reviewed again by the same panel of experts who gave their consent to administer the final revisions.

Instrumentation

The researcher anticipated that this process would produce at least 75 to 100 participants to respond to the survey. Of the 171 survey responses requested, 83 were returned for a return rate of 49%. Babbie (1990) stated that a 50% response rate is needed for significant analysis. The data collection period lasted approximately two weeks. Each participant then received three reminders after the surveys had been issued. The reminder emails were sent to the participants on days seven, ten and thirteen. Confidentiality of data collected was strictly protected.

The survey choices ranged from one to four, one being strongly disagree and four being strongly agree. The survey instrument was considered to be a forced-choice survey. Force choice surveys are often utilized to present the respondents with a choice between alternatives. Additionally, research suggested that forced choice question format encourages deeper processing of response items (Smyth, Dillman, Christian, & Stern, 2006).

Focus Group Interviews

The final aspect of data collection occurred through focus group interviews that were conducted late October (see Appendix C). Focus groups have many advantages for research (Gall et al., 1996). One advantage is that it decreases the tendency of interviewees to become bias in their statements. Furthermore, they assist the researcher in gathering large amounts of information quickly and raise issues that would normally not occur with one-on-one interviews. Patton (1990) detailed the purpose of the interview.

A primary purpose of these interviews was to gain more meaningful knowledge from teachers and facilitators about their perceptions of the ASIM professional development experiences. According to Creswell (2002), focus groups are in-depth group interviews of 5-8 people. Interviewing was viewed as possibly the most common data collection technique used in qualitative studies in education and program evaluation (Denzin & Guba, 1998; Merriam, 1998).

> The purpose of interviewing is to find out what is in and on someone's mind. The purpose of open-ended interviewing is not to put things in someone's mind…but to access the perspective of the person being interviewed. We interview people to find out from them those things we cannot directly observe…We cannot observe feelings, thoughts and intentions. We cannot observe behaviors that took place at some previous point in time. The purpose of interviewing, then, is to allow us to enter into the other person's perspective. (p. 278)

Eighty-three fellow teachers and two facilitators were notified via email requesting their participation in the focus group interviews. The focus group interviews were conducted in order to explore further the themes and patterns revealed in the survey analysis and to gain more in-depth information about what participants perceived as the strengths and limitations of ASIM as a professional development experience. The researcher recruited six teachers and two facilitators based on their willingness to voluntarily participate in the focus group interviews. Once teachers

agreed to participate, the researcher then set a date, time, and location that were suitable for each person involved in the study.

The focus group interviews were conducted in a central location in one of the classrooms at a master site agreed upon by the participants. The focus group consisted of six teachers and two facilitators from North Alabama. The focus group only met once. Prior to the interviews being conducted, each interviewee was given a consent letter to sign, acknowledging his/her approval of the willingness to participate in the interview process. Each participant received a snack bag with chips, drink and candy. Follow-up interviews were conducted only if there was a need for clarity from those who participated in the study.

The participants were welcomed by the researcher as they arrived at the interview location. So that each participant would felt comfortable, the desks were arranged in a circular pattern where each person could see the other. The researcher began with a standard introduction which included a welcome, an overview of the topic, the basic ground rules and a breakdown of the interview process. The interviewees were also reminded that the conversations would be tape recorded but would be strictly confidential. In addition, the interviewees were informed that the recordings would be discarded of promptly after transcription occurred.

The focus group interview took approximately 45-50 minutes in which to complete. The participants were asked eight questions and allowed to respond to each orally. As a back-up to the oral interviews, the researcher also allowed the participants to write down responses, and the interview session was tape recorded. The audio recorded interviews were stored in a locked file box at the office of the principle investigator. Gall, Borg, and Gall (1996) stressed that tape recording interviews allows for a more extensive study than taking notes, speeds up the interview process and provides complete verbal records. For results, a list of repeating themes and patterns

were derived from the responses of the participants (see Appendix E). The information was thoroughly analyzed and destroyed immediately after transcription.

Data Analysis

In an effort to address the research questions in this study, a mixed-method design was utilized by the researcher. The researcher administered a survey which collected quantitative data, solicited open-ended questions on the survey and conducted a focus group interview to obtain a triangulation of data from the participants. Triangulated data was employed to enhance confirmation of the qualitative findings. Triangulation is a way of examining the consistencies of various data sources (Patton, 1990).

The returned questionnaires were collected and statistically analyzed using the Statistical Program for the Social Sciences (SPSS) 17.0. *A* Pearson correlation coefficient test (Pearson *r*) was employed to determine whether a statistically significant relationship existed between Biology/Chemistry teachers' perceptions of the quality of the ASIM training and implementation of the ASIM Modules into classroom instruction (see Null Hypothesis 1). The Pearson correlation coefficient test was administered at the 0.01 level of significance.

The responses from the open-ended survey questions and the focus group interview questions were analyzed line-by-line for similar and reoccurring themes. This process is known as microanalysis and involves interpreting data through the process of coding. Creswell (1998) recommended using open coding and selective coding to draw upon common themes and patterns regarding participants' *Perceptions of the Alabama Science In Motion (ASIM) Modules and Professional Development Experience.*

Open coding was used to identify, name, categorize and describe a phenomena or event. The researcher compared the data and placed similar events into specific categories. Selective

coding was utilized in order to integrate categories and draw upon common themes and patterns. To complete the process of data analysis, the researcher compared the open-ended questions and focus interview questions with the quantitative responses from the survey. Finally, at this point, the researcher was at the point of data collection.

CHAPTER IV:

PRESENTATION OF DATA

Introduction

The purpose of this study was to 1) investigate biology teachers' and chemistry teachers' perceptions of the Alabama Science in Motion (ASIM) Initiative professional development experience regarding the impact it has on secondary science classroom teachers' instructional practices; and 2) to ascertain the teachers' perceptions regarding strengths and limitations of the *ASIM* professional development experience. This study was also conducted to determine whether a correlation existed between biology and/or chemistry teachers' perceptions of the quality of ASIM training and successful implementation of training.

This chapter consists of the following: 1) descriptive information regarding participants' perceptions regarding the ASIM training and implementation; 2) an analysis of the null hypothesis; and 3) qualitative analysis of teachers' perceptions of the ASIM training and implementation of ASIM modules.

Descriptive Information Regarding Teachers' Perceptions Regarding the ASIM Training and Implementation

There were various questions listed on the survey instrument on the subject of descriptive information regarding participants' perceptions of the ASIM training and implementation. Question items 1-19 addressed information relevant to participants' perceptions of the ASIM training and implementation. Descriptive data obtained from the participants in this study revealed the following information as displayed in Appendix F.

Question 1 of the survey instrument revealed that 98% of the participants either strongly agreed or agreed that the training they received at the ASIM Summer Institute prepared them for biology/chemistry activities compared to 2% that strongly disagreed or disagreed with the question item. Specifically, thirty-one participants agreed that the ASIM training prepared them for successful implementation of the biology and/or chemistry activities whereas 49 strongly agreed. While only one person disagreed and one respondent strongly disagreed. Results of Question 2 indicated that 94% of the participants either strongly agreed or agreed that their participation in hands-on learning activities at the ASIM Summer Institute was important for successful implementation of the biology/chemistry activities, whereas, 6% of the participants strongly disagreed or disagreed with the question item. More specifically, only two respondents strongly disagreed while three respondents disagreed. On the opposite end, 28 participants agreed while 49 respondents strongly agreed that hands-on participation was important for successful implementation of the biology and/or chemistry activities. For Question 3, 96% of the participants indicated feeling confident in their ability to manage the ASIM biology/chemistry modules when implementing the activities compared to only 4% of the participants that strongly disagreed or disagreed with the question item. To be more specific, 52 participants strongly agreed and 25 participants agreed that they were more confident in managing the modules when implementing the activities while only three participants disagreed. In reference to Question 4, 92% of the participants strongly agreed or agreed that after attending the ASIM training, they spend more time facilitating group activities with their students than before the training compared to only 4% that strongly disagreed or disagreed with the question item. Specifically, 38 participants strongly agreed and/or agreed that more time is spent facilitating group activities

as a result of the training whereas only five participants disagreed and two participants strongly disagreed.

Information displayed in Appendix F also addressed question items 5-8 of the survey instrument. Descriptive data for question item 5 revealed that 95% of the participants indicated feeling comfortable asking the ASIM facilitator to work with them compared to 5% of the participants who did not feel comfortable asking the ASIM facilitator to work with them. A specific breakdown revealed that 58 participants strongly agreed and 20 participants agreed that they were comfortable seeking assistance from the facilitator while only four individuals disagreed. Question 6 of the survey instrument revealed that 89% of the participants teach hands-on science more often now that they have the ASIM modules, whereas, 11% of the participants indicated not teaching hands-on sciences now that they have the ASIM modules. To be more specific, 40 participants strongly agreed that they incorporate more hands-on science in their instruction and 33 participants agreed to the question item. In addition, eight participants disagreed with the question item while only one participant strongly disagreed.

Furthermore, in reference to Question 7, 98% of the participants strongly agreed or agreed that modules provided by ASIM are adequate for the implementation of the ASIM Biology/Chemistry activities, compared to only 2% of the participants that strongly disagreed or disagreed with the question item. Specifically, only one participant disagreed and/or strongly disagreed whereas 36 participants agreed and 44 participants strongly agreed that the ASIM modules were adequate for the implementation of the activities Biology and/or chemistry activities. Question 8 of the survey instrument also revealed that 98% of the participants indicated that the learning needs of students of various abilities can be met through ASIM biology/chemistry activities, whereas, 2% of the participants that strongly disagreed or disagreed

with the question item. A specific breakdown revealed that 38 participants strongly agreed and 41 participants agreed that the ASIM modules met the needs of various learning abilities while only one respondent disagreed and/or strongly disagreed.

Information also displayed in Appendix F addressed question items 9-12 of the survey instrument. Results of Question 9 revealed that 98% of the participants strongly agreed or agreed that they find enjoyment in teaching biology/chemistry using the ASIM modules that are delivered to their school compared to 2% that strongly disagreed or disagreed with the question item. More specifically, only one participant disagreed and/or strongly disagreed with the question item, whereas twenty-five participants agreed and fifty-four participants strongly agreed that after using the ASIM modules they found more enjoyment in teaching biology and/or chemistry. Likewise for Question 10, 98% of the participants strongly agreed or agreed that the learning modules assisted them in the implementation of the standards on the science portion Alabama Course of Study, whereas, 2% of the participants strongly disagreed or disagreed with the question item. As stated more specifically, 50 participants strongly agreed with the question item while 31 participants agreed that the ASIM activities was of assistance in the implementation of the Alabama Course of Study Standards. Only one participant disagreed and/or strongly disagreed with the same question item.

Descriptive data for Question 11 revealed that 83% of the participants strongly disagreed or disagreed that the management of the ASIM biology/chemistry modules is challenging for them compared to 17% of the participants that strongly agreed or agreed that the management of the ASIM biology/chemistry modules is challenging for them. A specific breakdown revealed that 49 participants disagreed and eighteen participants strongly disagreed that the management ASIM modules were challenging, while 12 participants agreed and only two respondents

strongly agreed to the question item. Further, as indicated by the responses to question 12, 94% of the participants strongly agreed or agreed that the materials included in the ASIM biology/chemistry modules meet their needs compared to 6% of the participant that strongly disagreed or disagreed with the question item. Specifically, of the 83 participants, 40 agreed and 88 participants strongly agreed that the materials contained in the ASIM modules meet their needs. Four participants disagreed and only one participant strongly disagreed with the question item.

Information displayed in Appendix F addressed question items 13-16 of the survey instrument. Descriptive data for Question 13 indicates that 95% of the participants strongly agreed or agreed that training at the ASIM Summer Institute covered the content knowledge and pedagogy necessary for implementing the activities, whereas, 5% of the participants who strongly disagreed or disagreed with the question item. A specific breakdown revealed that of the 83 participants, 44 strongly agreed, while 34 agreed that the ASIM training covered the content knowledge and pedagogy needed for implementation of the activities. Only four participants disagreed with the question item. For Question 14, 89% of the participants strongly agreed or agreed that as a result of the ASIM training, they include more hands-on activities than before the training compared to 11% of the participants that strongly disagreed or disagreed regarding the question item. More specifically, only one participant strongly disagreed while eight participants disagreed with the question item. Additionally 38 participants agreed with this question item and 36 participants strongly agreed that after attending the ASIM training, they include more hands-on activities than before. For Question 15, 86% of the participants strongly agreed or agreed that as a result of the ASIM training, they include more effective questioning during Biology/Chemistry instruction than before the training compared to 14% of the

participants that strongly disagreed or disagreed with the question item. Specifically, 45 participants agreed and 25 participants strongly agreed that more effective questioning was included as a result of the ASIM training. Eleven of the 83 participants disagreed with the question item, while only one participant strongly disagreed. Question 16, 98% of the participants thought that teaching with ASIM materials has been beneficial to their students' understanding of biology/chemistry, whereas, 2% of the participants strongly disagreed or disagreed that teaching with ASIM materials has been beneficial to their students' understanding of biology/chemistry. A more specific breakdown revealed that only one participant strongly disagreed and one participant disagreed with this particular question item. Forty-three participants strongly agreed and 38 participants agreed that teaching with the ASIM materials has been beneficial towards student understanding.

Information found in Appendix F addressed question items 17-19 of the survey instrument. Descriptive data for Question 17 revealed that 97% of the participants in the study strongly agreed or agreed that because of the ASIM training they are more effective as a Biology/Chemistry teacher compared to 3% of the participants that strongly disagreed or disagreed with the question item. A specific breakdown revealed that 43 of the 83 participants agreed that because of the ASIM training, they are more effective as a teacher. Only two participants disagreed with the question item and one participant strongly disagreed. Question 18 of the survey instrument revealed that 96% of the participants strongly agreed or agreed that their students show an increased interest and motivation to learn biology/chemistry when participating in ASIM, whereas, only 4% of the participants strongly disagree or disagreed the question item. Specifically, forty participants agreed and 40 of the 83 participants strongly agreed that their students showed an interest and motivation to learn when using the ASIM activities. Two

participants disagreed and one participant strongly disagreed to the question item. Descriptive data for Question 19 revealed that 99% of the participants in the study strongly agreed or agreed that overall, they thought ASIM promoted an effective way to teach biology/chemistry compared to 1% of the participants that strongly disagreed or disagreed with the question item. More specifically, 29 participants believe that ASIM promotes an effective way to teach biology and/or chemistry, while 52 of the 83 participants strongly agreed. Only one of the participants strongly disagreed with the question item listed.

An Analysis of the Null Hypothesis

Null Hypothesis 1: There is no statistically significant relationship between biology/chemistry teachers' perceptions of the quality of the ASIM training and implementation of the ASIM Modules into classroom instruction.

This section of the chapter will report the findings of the null hypothesis. A Pearson correlation coefficient test (Pearson *r*) was employed at the 0.01 level of significance to determine whether a statistically significant relationship existed between biology/chemistry teachers' perceptions of the quality of the ASIM training and implementation of the ASIM Modules into classroom instruction. To determine whether a statistically significant relationship existed in the perceptions of Biology/Chemistry teachers, various questions were compiled to test this hypothesis. Question items 1-15 comprised the perception scale for perceived quality of ASIM training (see Appendix B). Question items 16-19 comprised the perception scale for implementation of ASIM Modules (see Appendix D). A factor analysis was conducted to calculate an average mean for each of the combined questions. Results of the data revealed that a statistically significant relationship did exist between Biology/Chemistry teachers' perceptions of

the quality of ASIM training and implementation at the ASIM Modules into classroom instruction (see Table 3).

Table 3

Descriptive Results of Pearson Correlation regarding the Relationship between Biology/Chemistry Teachers' Perceptions of the Quality of ASIM Training and Implementation of the ASIM Modules into Classroom Instruction.

Variables	N	M	SD
Quality	83	3.45	.495
Implementation	83	3.13	.345

Correlation Table

Variables	N	*R*	r^2	P-value
Quality	83	.704	.49	.000*
Implementation	83			

*Significant at the 0.01 level.

Based on the results of the data analysis, a statistically significant relationship was found between biology/chemistry teachers' perceptions of the quality of ASIM training and implementation of the ASIM Modules ($r = .704$, $r^2 = .49$, $P = .000$); therefore, the null hypothesis is rejected at the 0.01 level of significance because a statistically significant relationship did exist between the two variables. Data analysis, as displayed in Table 3, suggests that biology/chemistry teachers who perceived the ASIM training as high quality also had success during the implementation of the ASIM Modules into classroom instruction because of the positive correlation ($r = .704$), which indicates a strong relationship between the two variables. In addition, about 50% ($r^2 = .49$) of the variance of implementation can be explained by

biology/chemistry teachers' perceptions of the quality of training. Results of the null hypothesis were supported through studies conducted by Chang and Mao (1999), Schneider et al. (2002), Robinson (2005), and Taraban et al. (2007).

An Examination of Open-Ended Qualitative Questions Regarding Participants' Perceptions of ASIM Modules and Training Overview

Eighty-three biology teachers and chemistry teachers were asked to respond to various open-ended questions for the purpose of obtaining their perceptions of ASIM professional development training and the use of the ASIM Modules in classroom instruction. The following section provides a detailed account of the responses given by each of the participants (see Appendix D). Through an examination of the open ended qualitative questions regarding teachers' perceptions of the ASIM Modules, common themes and patterns have been grouped together and presented for consideration.

Each participant represented in the study was asked the following: 1) what are the greatest strengths of the ASIM Modules; 2) what are the greatest limitations faced with the ASIM Modules; 3) what do you see as areas for improvement in ASIM modules; 4) how has your teaching of biology/chemistry changed since you attended the ASIM Summer Institute; and 5) briefly describe how you have implemented the ASIM biology/chemistry modules and kits in your classroom. These questions were asked to ascertain the level of understanding of how participants perceived the ASIM modules and training to bring about positive changes and improvements between ASIM professional development training and implementation of ASIM Modules.

Question One:

What are the greatest strengths of the ASIM Modules?

Participants in the study were asked to indicate what they perceived as the greatest strengths of the ASIM Modules. Based on the responses of the participants, there were three common themes and patterns formed: 1) Accessibility of Materials/Hands-on Activities/Instruction; 2) Support; and 3) Equipment and Financial Resources (see Appendix D). The majority of the participants indicated that greatest strengths of the ASIM modules were accessibility of materials/hands-on activities/instruction (For complete information, see Appendix G). Common themes and patterns of participants' responses are listed below.

1. Accessibility
    a. Just having access to these modules would be one of the greatest strengths
    b. If not for ASIM I would not be able to offer many hands-on activities to my students
    c. The modules address standards and topics in a fun and innovative way.
2. Support
    a. Assistance provided by ASIM Biology Specialist
    b. I love having Mrs. Doe teach some of the labs that I do not feel comfortable with
    c. Provides training for new chemistry teachers
3. Equipment
    a. The ASIM modules are "all inclusive" and provides equipment that our schools could not afford
    b. Saves schools money and time

c. Much of the equipment collects the data, allowing students to put more effort into analysis

Question Two:

What are the greatest limitations faced with the ASIM Modules?

For the second question, participants were asked to indicate what they perceived as the greatest limitations of the ASIM Modules. Based on the responses of the participants, there were five common themes and patterns formed: 1) scheduling/delivery/availability; 2) equipment; 3) funding; 4) instruction; and 5) time (see Appendix D). The majority of the participants indicated that the greatest limitations of the ASIM modules were scheduling/delivery/availability (see Appendix G). Common themes and patterns of participants' responses are listed below.

1. Scheduling/Delivery/ Availability
    a. High demands
    b. Due to cuts in personnel of ASIM the delivery comes only once every two weeks
    c. You have to wait if another teacher is using the modules and if you aren't a great planner, then you just get it when you can
2. Equipment
    a. Equipment needs to be updated often
    b. Maintaining the modules in excellent condition is an ongoing challenge
    c. Teachers not cleaning equipment after use before passing lab to next user
3. Instruction
    a. Extensions- graphs, data analysis, etc….
    b. Some of the modules are not geared toward higher level classes

c. Many are cookbook labs

4. Time

    a. Squeezing some of the modules into 48 min classes

    b. The modules are too time consuming

    c. Trying to help others see that instructional time should be protected

Question Three:

What do you see as areas for improvement in ASIM Modules?

Furthermore, participants were asked to indicate what they perceived as areas for improvement in ASIM Modules. Based on the responses of the participants, there were six common themes and patterns formed. They included the following: 1) instruction; 2) equipment; 3) training/trainers; 4) funding; 5) availability/delivery; and 6) time (see Appendix D). The majority of the participants indicated that one of the areas of improvement in ASIM modules is instruction (see Appendix G). Common themes and patterns of participants' responses are listed below.

1. Instruction

    a. More activities for lower level classes

    b. Some of the labs are very wordy which causes the students to be bogged down with reading so much

    c. Having more of the same modules to go out to the schools on the most popular ones

2. Equipment

    a. Individual professional accountability of teachers

    b. Equipment need to be updated periodically

c. Keep the kits in top working order… the ASIM Project Director need assistants who do ONLY that

3. Training/Trainers

   a. More interaction with the ASIM facilitator

   b. More access to training

   c. Having more support so that fewer schools have to be represented by one ASIM Director

4. Funding

   a. More state and national funding

   b. More money on the program

   c. Funding should be provided by the State Department to continue Summer Institute

5. Availability/Delivery

   a. Delivery and Availability Time

   b. More module availability of each kind so they can be more readily available

   c. Having more modules of the popular labs available for use by more teachers

6. Time

   a. More time for implementation

   b. Shorten the time the activity requires

Question Four:

How has your teaching of biology/chemistry changed since you attended the ASIM Summer Institute?

Participants were also asked to indicate how their teaching of biology/chemistry changed since attending the ASIM Summer Institute. Based on the responses of the participants, there were two common themes and patterns formed: 1) more hands-on activities and 2) resources (see Appendix D). The majority of the participants indicated that their teaching of biology/chemistry changed as a result of the training in regards to instruction/equipment/materials (see Appendix G). Common themes and patterns of participants' responses are listed below.

1. More Hands-on Activities
    a. I teach less and facilitate more. I question my students and look for understanding. They take charge more and have learned to rely on me less and less for answers
    b. I have always used hands-on teaching, but the ASIM modules make it easier as I do not have to purchase everything I need to do more hands-on
    c. I use more labs and inquiry based learning strategies
2. Resources
    a. More confidence and less stress related to lab materials, set-up, and procedures
    b. Better time management
    c. Brings science to life! Makes it real!

Question Five:

Briefly describe how you have implemented the ASIM biology/chemistry modules and kits in your classroom.

Participants were also asked about their implementation of ASIM Biology/Chemistry modules and kits in classroom instruction. Based on the responses of the participants, there were three common themes and patterns formed: 1) biology implementation; 2) chemistry implementation; and 3) biology/chemistry (see Appendix G). Common themes and patterns of participants' responses are listed below.

1. Biology Implementation
    a. I use many of the genetics modules in my Biology class when teaching that section of the course
    b. I use at least one module per testing unit in biology
    c. I use ASIM modules to begin or introduce a new biological concept. Or I use the modules to reinforce concepts that I have taught. The modules provide input on student misconceptions
2. Chemistry Implementation
    a. I use 1-2 kits a week in my Chemistry class. They are great for my Chemistry class and my IB Chemistry class. I can use them as is or adapt them to be a little higher level needed
    b. I have integrated the ASIM modules into my Chemistry curriculum in such a way as to give students experience with a concept before teaching the concept itself
    c. I use ASIM modules either to begin a topic, or conclude a topic.

3. Biology/Chemistry Implementation

    a. I use the kits to improve the understanding of topics throughout the text

    b. I have included some ASIM labs that I did not previously do with my classroom

    c. Modules and kits are implemented into every content standard as an introduction of review

An examination of five open-ended qualitative questions of participants' perceptions of the ASIM module and training revealed the following:

1) the greatest strengths of the ASIM modules were accessibility of materials, hands-on activities, instruction, support, and equipment and financial resources;
2) the limitations faced with the ASIM modules were scheduling, delivery, availability, equipment, funding, instruction, and time;
3) areas for improvement in ASIM modules were instruction, equipment, training/trainers, funding, availability/delivery, and time;
4) the majority of the participants reported incorporating more hands-on activities and having more resources since attending the ASIM Institute; and
5) participants briefly described implementing the ASIM biology/chemistry modules and kits in their classrooms in three ways: biology implementation, chemistry implementation, and biology/chemistry implementation combined.

The themes and patterns that were derived from the survey and the open-ended questions corresponded to those of the focus group interviews. Ninety-two percent of the participants said

that as a result of the ASIM experience, they spend more time facilitating group activities than before the training. One teacher from the focus group interview echoed this by stating:

> I definitely implement more hands-on biology lessons than before I went to training. Before training I only had labs that were provided by the textbook or textbook resource books. These labs proved to leave my students uninterested and required money to purchase materials. It didn't take long before I cut out all labs due to the lackluster responses of students when told that we would do another lab. Now, with the help of Alabama Science in Motion, students look forward to labs and ask when they will do another. The labs are challenging and apply to real life situations in biology which give the students purpose.

A different teacher said:

> Yes, science in motion is a good reinforcement to the concepts that I have taught. It is a good way to reach kinesthetic learners. It is really easy on the teacher as well, with all the material already provided for you; why not implement more hands-on activity.

Another comparison made with the data collected was about what teachers saw as strengths and limitations of the overall ASIM program. According to the open-ended questions, participants thought that the accessibility of materials was one of the greatest strengths of the ASIM experience. One teacher was quoted as saying:

> Having valuable materials and lab experiences that would be virtually impossible for science teachers to provide for their classes, with no classroom supply monies is one of the greatest strengths of this training.

Adding further comments that were shared during the focus group interview was from a fairly new teacher. He was noted as saying that he enjoyed the lab modules because:

> The labs correlate with the Alabama Course of Study objectives and there is no cost on the teacher to create or replenish the labs.

In conclusion, the data obtained from the data sources revealed that the responses correlated across the board. The participants who responded to the quantitative data responded similarly to those who participated in the focus group interviews to gather the qualitative data. The triangulation of data collection allowed the researcher to compare different sets of data.

Summary

This chapter addressed information regarding biology and chemistry teachers' perceptions of the ASIM Initiative professional experience and the impact it has on secondary science classroom teachers' instructional practices. There were a total of 83 biology and chemistry teachers represented in this study. Seventy-one percent of the participants in the study indicated having earned their master's degree, and between 6 to 15 years of teaching experience. In addition, fifty two of the eighty three participants also reported having up to five years of experience using the ASIM Modules (see Table 2).

Descriptive information regarding participants' perception of the ASIM as displayed in Table 3 revealed that the majority of the participants strongly agreed or agreed with each of the question items that the training they received at the ASIM Summer Institute prepared them for successful implementation of the biology/chemistry activities. However, question 11 of the survey instrument, the majority of the participants strongly disagreed or disagreed that the management of the ASIM biology/chemistry was challenging for them.

An analysis of the null hypothesis revealed that a statistically significant relationship did exist between biology/chemistry teachers' perceptions of the quality of the ASIM training and implementation of the ASIM Modules into classroom instruction at the 0.0l level of significance ($r = .704$, $r^2 = .49$, $P = .000$). The null hypothesis is rejected at the 0.0l level of significance because a statistically significant difference did exist between the two variables. Results of the Pearson Correlation as displayed in Table 8, suggested that biology/chemistry teachers who perceived the ASIM training as high quality also had success during the implementation of the ASIM modules into classroom instruction because of the positive correlation ($r = .704$), which indicates a strong relationship between the two variables.

CHAPTER V:

FINDINGS, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

The primary purpose of this study was to investigate biology and chemistry teachers' and facilitators' perceptions of the ASIM professional development experience with regard to the impact, if any, it has on secondary science classroom teachers instructional practices. In addition, the purpose of this study was to reveal what teachers and facilitators perceived as strengths and limitations of the ASIM professional development overall experience. The researcher employed a Pearson r coefficient to determine whether a correlation existed between biology/chemistry teachers' perceptions of the quality of ASIM training and successful implementation of training? Two research questions were examined in this study. They included the following:

1. How do biology and chemistry teachers and the facilitators perceive the Alabama Science in Motion professional development experience; and
2. What do the teachers and facilitators perceive as strengths and limitations of the Alabama Science in Motion professional development experience?

Specifically, this chapter summarizes the major findings within this study. This chapter consists of three sections: 1) summary of research findings; 2) implications and recommendations; and 3) conclusions.

Science education in the United States today is in serious need of an overhaul (Wenglinsky & Silverstein, 2007). According to the 2008 National Assessment of Educational Progress (NAEP) science exam, results revealed that U.S. students failed to make the progress needed to compete with other countries. Very little progress was made which brought attention

to the fact that there is still much work to be done in order to reform our nations' schools. Efforts have been made to address the needs of various learners (Geier et al., 2008). Research has suggested that although there are many steps needed to improve U.S. science education, the most critical area is improving teacher professional development training (Wenlinsky & Silverstein, 2007; Suporitz & Turner, 2000; NSES, 1996). With this in mind, research must be studied that focus in on whether or not reforming through teacher professional development will be the change needed to bring our students to a more strongly academic competitive level. The findings of the study are discussed in this chapter.

Teachers' Perceptions of ASIM

The participants in this study responded to a set of survey questions that included five open-ended questions. The responses to the survey items and open-ended questions yielded similar reoccurring themes and patterns. The favorable perceptions of ASIM teachers might be accredited to the fact that these teachers have already been teaching using processes consistent with those supported by the ASIM program. The responses from the participants were used as an analysis to summarize the study.

Teacher Confidence

It was concluded that the majority of the participants found the ASIM training to play a vital part in their classroom instructional practices. Teachers felt that they were less apprehensive about completing labs with their students. Teachers also said the idea of having prepared lab sets gave them a renewed sense of confidence. In fact, 99% of the participants strongly agreed overall that ASIM modules had a positive impact on teaching biology and chemistry. In a 2002 study by Von Secker, it was revealed that there was a strong correlation between student achievement in the classroom and hands on learning.

Instructional Practices

An overwhelmingly large amount of teachers stressed that the ASIM training appeared to play a vital part in their instructional practices. It was perceived by the participants that teaching with ASIM modules was a more effective way of teaching and learning. Many of the teachers believed that students made the connection between theory and practice when the ASIM modules were used before or after a concept was presented. In fact, 63% of the participants were strongly agreeable to the fact that the ASIM modules were a more effective way of teaching and learning whereas only 1% were in opposition. A supporting study conducted by Taraban et al. (2007) reported that students who were taught using laboratory exercises gained more content knowledge versus those who were taught using a traditional teaching method. In a similar study, Taiwan et al. (1999) also revealed that students scored higher on earth science tests after being taught through the inquiry method of teaching as opposed to the traditional teaching method and were more favorable of inquiry instruction. While this study did not specifically measure student achievement, teachers believed that their students were more actively involved because of the displayed increase in classroom participation.

Thoroughness of Training

Wenglinsky and Harold (2007) found that teachers who attended extensive science trainings had a better understanding of their students' difficulties as it related to the lab because of the challenges they faced themselves. Teachers who attended the ASIM training were taught using inquiry-based instruction for an extensive two-week period. Findings from this study revealed that the teachers who attended the ASIM training were much more confident in the implementation of the ASIM modules by the time the training ended. Teachers even said that they now implement more labs during the year as a result of the ASIM training. More so,

teachers believed that the idea of attending a workshop that was extensive and content specific was the main difference in their instructional practices. Professional development according to Darling-Hammond and Richardson (2009), that was less than 14 hours in length showed no effects on learning whereas those over 30 hours were largely effective. Contrarily, Garet et al. (2001) found that while time was a key factor in effective professional development, time alone does not guarantee success unless focused on subject-matter content.

Hands-On Learning

Teachers believed that the training adequately prepared them for the implementation of the modules within their classrooms. Supovitz and Turner (2000) found that when teachers spend time utilizing the hands-on approach to science learning, the more the inquiry learning process was implemented into their classroom instruction. Likewise, 98% of the participants believed that the students had a better overall understanding of biology and chemistry after being taught with the ASIM modules. For example, teachers felt that students In fact, Taraban, Box, Myers, Pollard, and Bowen (2007) found that students gained more content knowledge as a result of inquiry based learning versus non-hands on learning.

Participants stressed just how much more time was actually spent doing hands-on classroom activities since attending the ASIM training. In fact, many of the teachers said they do at least one lab per week and also include teacher demonstrations. More importantly, they believed that doing so strongly altered the attitudes of their students. One teacher even said "Now, with the help of Alabama Science in Motion, students look forward to labs and ask when they will do another." As a result, students became more motivated about taking part in lab exercises and even more engaged in the learning activities. Also, students had an increased interest in the subject area of biology and chemistry. Gupta (2004) and Doymus (2007)

conducted studies that yielded results that support the fact that students learn at elevated levels when allowed to work kinesthetically with their classmates.

Teacher Implementation

Darling-Hammond and Richardson (2009) pointed out that to avoid inconsistencies between teachers' knowledge gained from professional development and their implementation into their classrooms, there should be a link between curriculum, assessment, and standards. The participants perceived the modules to be very helpful in the implementation the basic Alabama Course of Study (ALCOS) standards. In fact, one teacher was quoted as saying, "they are content based labs that meet graduation exam criteria". A large majority of the participants stated that the ASIM program supplied several different modules for each ALCOS standard. They believed that the modules meet their needs and the needs of the students.

One teacher pointed out how the ASIM modules addressed standards and topics in a fun and innovative way. A different teacher expressed how important the modules were to the science curriculum and how the ASIM program furnished high quality labs for student use. Specifically, teachers were pleased with the fact that the modules introduced standards to the students that are asked on the Alabama High School Graduation Exam. Another teacher enjoyed the fact that the modules meet various levels of learners and they were even helpful with kids with learning disabilities. Many of the teachers believed that because students' possess various learning styles, the ASIM modules were most beneficial for the success of their students. McCarthy (2005) found that students with disabilities are more capable of science learning when using hands-on science material.

Chappuis et al. (2009) found that just as the classroom teachers played a major role in student achievement, the skills of the facilitator was a central component of classroom learning.

One teacher said that she loved having a facilitator available to teach some of the labs she was not comfortable with. A different teacher said that he liked the idea of having the biology facilitator deliverer the modules at the previously scheduled times. Furthermore, many of the teachers expressed how much they were pleased with the facilitators who were so willing to also assist in classroom implementation of the modules. Crandall (1983) found that the trainer was one of the most viable components of professional development simply because this person must have the ability to expose how new practices can be employed.

Open-Ended Questions and Findings

Participants were asked five questions that ranged from strengths and limitations to areas of improvement, if ASIM had altered their teaching and how the modules have been implemented into the classroom. A number of themes and patterns were formed from the responses collected throughout the study.

Question One:

What are the greatest strengths of the ASIM Modules?

Although the participants in the study shared numerous areas of strengths in reference to the ASIM program, the researcher focused in on those that were most reoccurring. Teachers reported that accessibility of hands-on material, instruction, support, equipment, and financial resources were the most common strengths of the ASIM program.

The idea of having the materials provided to teachers without having to purchase them was listed as one of the greatest strengths of the ASIM program. Several teachers reported that if it were not for the ASIM program, hands-on learning for students would not be possible. One teacher drew comparison stating that she appreciated the fact that the osmosis kit contained the eggs, vinegar and other supplies needed to thoroughly teach the lesson; unlike what she

remembered as a child when students learned primarily through textbooks and worksheets. Another teacher was quoted as saying, "the modules are standard based and interesting to students." As a result, the teacher felt a greater need to implement more labs and activities since the kits contained the necessary supplies. Many teachers in this study simply said they felt the labs were comprehensive and they made it easier to teach a specific subject.

Teachers reported that material availability for classroom instruction although schools are limited in funds was also considered as strength of the ASIM program. While this study did not focus on student achievement, teachers strongly believed the hands-on instruction related to the ASIM modules had a positive and beneficial impact on student learning. One teacher was quoted as saying the modules "motivated her students and provided a different outlook to similar problems. I can appreciate the impact that this has on their ability to think critically". Supporting studies conducted by Dreier (2002) and Wheeler (2007) found that hands-on learning had an impact on student achievement.

The support teachers receive from trainers was also noted as an additional strength of the ASIM program. Teachers said just having the trainer present made a difference in the level of confidence exhibited when completing a module. For example, teachers reported that the trainer stepped in when not sure what the next process was or just not sure of the next process. Chappuis et al. (2009) found that trainers are most beneficial in assisting teachers.

The ASIM program gave students the opportunity to utilize equipment that would otherwise be impossible to obtain or afford. A large number of teachers were appreciative of the fact the modules were "all-inclusive" for the students. Additionally, teachers strongly felt that students found enjoyment in using the equipment which means it had a positive effect on the students.

Because of declining financial resources, teachers believed that if it were not for the ASIM program, their students would struggle with new biology/chemistry concepts. For this reason, one teacher shared that "the modules were convenient, accessible, a time-saver, and basically the modules brought science to life for students". The need to update the equipment and offer more training opportunities was of great importance to the majority of the participants.

Question Two:

What are the greatest limitations faced with the ASIM Modules?

Just as themes and patterns were formed with strengths of the ASIM program, the same occurred with the limitations. Oddly enough, some of the same themes for strengths were noted by teachers as limitations. The participants indicated that there were five common themes and patterns formed for the limitations. One of the most popular limitations was scheduling/availability. Other limitations revealed were equipment, funding, instruction and time.

With many of the modules being popular and in high demand according to various schools, teachers pointed out that many of the modules students enjoyed most were difficult to obtain. For example, the genetics lab would have to be reserved early in order to receive the kits when the topic is introduced. Teachers would have to schedule weeks in advance just to get the modules when needed. Teachers believed they had to rush through a lab activity or return kits before having an opportunity to utilize with their class because of time constraints. Several teachers were noted as saying that conflicts occurred with their long-range lesson planning when labs were not available as previously expected. Furthermore, this not only interfered with their teaching schedule but with the instruction that was required prior to students sitting for the science portion of the graduation exam.

Funding and equipment for many of the teachers was also cited as an obvious limitation. Funding was mainly addressed because of past and future budget cuts. With budget cuts, teachers reported that it was extremely difficult for the one available trainer to get around to schools and assist teachers as needed. Teachers pointed out that lack of time and money places a huge burden on the trainers considering the tasks that they have to accomplish. One teacher was even stated as saying, "due to cuts in personnel of ASIM the delivery of modules comes only once every two weeks which makes it harder to plan." Chappuis et al. (2009) found that facilitators played a vital role in teacher successes because they were responsible for preparing agendas, time lines, meeting logs, and set-ups.

Last but not least, the final limitations of ASIM program that were derived from the research were instruction and time. Teachers complained that there were so many labs geared to the course standards, it was difficult to decide on which to use. Pressure from state and local government caused teachers to feel they had to rush through the modules before they could assure a student had full understanding of the concepts that were taught. Teachers reported that more time was needed for kits to remain at the schools to accommodate Pre-AP year-long courses. The greatest concern from the teachers was that the biology facilitators were more limited than the chemistry facilitators because of the number of Biology classes.

Question Three:

What do you see as areas for improvement in ASIM Modules?

Although findings from this study revealed that teachers exhibited favorable perceptions when it came to the overall ASIM experience, however, teachers pointed out many areas of needed improvement of the ASIM modules. Instruction, equipment, training/trainers, and

funding were the key areas of needed improvement of the ASIM modules as noted by the teachers.

It was apparent that several of the participants believed that new ASIM sets and more modules were needed because many of the kits were missing necessary parts. The kits were originally set up for 16 groups with two students per group, but because some of the kits have missing pieces, teachers are forced to put students in larger groups. In addition, an increase in audiovisual materials with the kits according to one participant would have been a welcomed area of improvement. A number of participants reported that with the number of years ASIM has been in existence, an increase in variety of labs modules would be great also. Attention from participants was directed to teachers not properly maintaining equipment in their care. Individual accountability of teachers was a major concern in reference to the care that was given to the ASIM kits. Teachers stressed that it was important for the ASIM facilitators to get assistance in keeping the kits in "top working order" and that the equipment needed to be updated periodically.

As far as instruction was concerned, one teacher indicated that some of the instructions could be rewritten into more understandable language for students who struggle with reading comprehension. Olson and Mokhtari (2010) recommended a research-based approach that aids teachers in classroom instruction in ways that permits them to teach reading skills in the context of science content knowledge. As far as some participants were concerned, most of the modules were not geared toward upper level classes like human anatomy and physiology. They believed that the program should create activities that are more diverse in nature.

Another area of improvement deals with the actual training and those responsible for the training. Teachers strongly suggest that more summer training is incorporated so that new

teachers have the same opportunity as they did. They further suggested that more facilitators are incorporated so that more teachers can be trained properly. Some teachers reported that as a result of the ASIM training, they were now better at hands-on instruction. Additionally, they shared that completing lab exercises after the training was now actually easier. Another concern from the teachers was having more ASIM facilitators spend time in the class to help complete various lab exercises.

Question Four:

How has your teaching of biology/chemistry changed since you attended the ASIM Summer Institute?

The results of this question yielded two patterns and themes from the participants in this study. Instruction and equipment/materials were listed as important areas of change for the participants. Teachers reported that they definitely include more hands-on instruction because of access to the equipment and materials. Their students were more actively engaged in learning scientific concepts and had a greater understanding of the topics covered.

For example, teaching the genetics topic was normally a topic of very little interest for them and their students; however, because of the interaction and engagement with their peers while using the ASIM modules teachers felt that students were more interested and better able to make the connection between theory and practice. One teacher mentioned that because of the ASIM training, teaching was more interactive with her students. Meanwhile, a different teacher said she has always utilized hands-on teaching but the ASIM modules reduced pressures of having to purchase supplies.

Resources were also a repeating pattern that consistently came up as a result of the study. Teachers reported that because of ASIM, they had the necessary instructional tools at their

fingertips. A chemistry teacher Ms. Jones explained that without opportunities offered from ASIM modules, many lab experiences would not occur. Better time management was possible because of the resourcefulness of the lab set ups and availability.

Question Five:

Briefly describe how you have implemented the ASIM biology/chemistry modules and kits in your classroom.

Teachers responded with a variety of ways in which they implemented the modules and kits into their classroom instruction. They stated that the ASIM modules were used to either introduce a new topic or to reinforce what had already been taught. Likewise, one teacher replied by saying that he integrated the ASIM modules into the chemistry curriculum in a way that gave students experiences with concepts prior to the lesson. He elaborated by stating, "Building on prior knowledge can be the difference between a lesson being a success or an utter flop." According to one teacher, lab investigations centered on the key themes detailed within the Alabama Course of Study.

By using the ASIM modules as lab demonstrations, the teacher was able to help students visualize what would have been taught or reinforce what was previously covered during the lesson. Participants reported that the ASIM modules were useful for all types of learners allowing the students the opportunity to grasp a better understanding of concepts. One teacher even said she believes that the activities promote kids to become more engaged in the learning process and to become more creative thinkers. Finally, teacher participants shared that they used ASIM modules as a means to reach ELL and inclusion students who has a difficult time comprehending scientific concepts.

Despite the limitations, teachers had positive attitudes towards the ASIM training and module implementations. Overwhelmingly, due to the ASIM modules and training, teachers believed that their instruction allowed for deeper student engagement while accessing the student's prior knowledge. Additionally, ASIM modules allowed teachers to effectively reach their ELL and special education students creating a more inclusive teaching and learning environment.

Summary of Focus Group Interview Responses

Conducting the focus group interviews were an essential component of this study. It allowed the researcher to gather a more complete and comprehensive analysis of teachers' and facilitators' perceptions as it relates to the ASIM professional development experience. The responses from the focus group interview were compared to that of the survey responses and the open-ended questions. Throughout the interview process, both the facilitators and participants were extremely optimistic about the ASIM professional development experience. In addition, each participant was willing to share as much as possible about their overall experience.

During the interview process, all the participants spoke very highly of the ASIM program. The overall responses from the teachers and facilitators indicated that they had a positive attitude towards the training and implementation of the ASIM modules and the program. They all believed the program was beneficial to them and the students they serviced. As a result of the focus group interviews, four themes were developed. They included the following:

1) ASIM caused teachers to implement more hands-on instruction;
2) ASIM creates more student engagement;
3) Supplying ASIM modules relieves the financial burden from teachers; and
4) ASIM needs to provide more lab kits.

Teachers' and Facilitators' Perspectives on Implementing ASIM Modules

At the close of the interview process, the researcher believed that the teachers and facilitators recognized an increase of ASIM implementation in the classroom. Most teachers stated that they definitely utilized more hands-on instructional practices as a result of the training. One teacher was quoted as saying,

> "It is really easy on the teacher, with all the material already provided for you; why not implement more hands-on activity."

A different teacher said:

> Because of ASIM training, I definitely implement more hands-on biology/chemistry lessons than I did before attending training. There are some labs that I have used in my classroom only after I attended the biology or chemistry sessions during the summer. The ASIM training during the summer gives me a chance to do the lab with an instructor present, so I can ask questions and be comfortable performing it on my own, with my students.

One of the facilitators was noted as saying:

> I absolutely believe that teachers implement more hands-on biology lessons. Moreover, many of the ASIM Biology and Chemistry lessons are being rewritten to include an inquiry based style of learning using the 5E methodology. This has proven invaluable in utilizing a style of learning in the science classroom that has been proven to be successful and impactful.

Additionally, the facilitator reported that teachers may not necessarily be doing more labs but believed that they have done more high quality technology based labs than done before. Teachers felt that because the ASIM program supply teachers with equipment that is most often impossible to purchase, teachers can keep up with the fast changes in technology. The DNA electrophoresis units and the dissecting microscopes are two examples of high tech equipment that teachers have access to, thanks to the ASIM program. According to several teachers, simple labs like the toilet tissue lab and the chromatography labs may not be high tech but serves a valuable part in what students learn.

Student Engagement with ASIM

Both teachers and facilitators expressed to the researcher how much the ASIM modules caused students to become more actively engaged in the learning process. Erin, a biology teacher said traditional teaching left her students none-interested and unengaged. But, with the help of ASIM, her students looked forward to doing labs and even asked when they would complete another one. She also said that through hands-on lessons, her students gained a better understanding of the material and can now better understand how biology applies to real life situations. One teacher echoed this when she was quoted as saying:

> There is a great push in education to implement more challenging, higher-order thinking questions. Alabama Science in Motion hands-on lessons asks students these higher-order thinking questions. Through training I was told to not only have students answer the questions given through the lesson, but also supply students with challenging questions of my own before, during, and after the lab (hands-on lesson).

Likewise, facilitators believed that the increase in popular lab usage was a result of sparked student interest in hands-on learning. Observations of students in action allowed teachers and facilitators to witness the excitement and curiosity in the students' eyes when they did the fractional distillation lab or when they did the preparation of aspirin lab. Most of the participants reported that the ASIM modules were more widely used because it gave the students a sense of purpose. One teacher specifically stated, "I encourage kids to become more involved and they are in turn more creative thinkers." The concept of the ASIM program according to the participants is to create more effective ways to administer the lesson. And, at the same time find creative and innovative ways to get students more involved in the learning process.

Funding of ASIM Modules

All participants indicated that one of the most rewarding benefits of the ASIM modules was the financial burden it removed from teachers. It was revealed that because modules were

furnished, teachers could focus their attention on purchasing classroom supplies for their students. One teacher was quoted as saying, "The ASIM program provides valuable materials and lab experiences that would be virtually impossible for science teachers to provide for their classes, with no classroom supply monies." Hanna, a fourth-year chemistry teacher, explained that the program was essential for schools that did not have the resources to provide lab opportunities for students. Additionally, she believed that funding was critical to the success of this professional development training.

Austin, a facilitator, stated she believed that supplying teachers the kits they needed in order to adequately cover the ALCOS objectives seemed to take a burden off of the teachers. It was manifested in their positive attitudes toward their students and daily activities. She further stated that teachers were "incredibly grateful for the service provided by ASIM." Additionally, she as well as other teachers felt that had it not been for the ASIM program, they would not have been able to offer students the quality lab experiences they now encounter.

With the State of Alabama undergoing back-to-back proration's teachers are very fearful that the ASIM program will be discontinued. Teachers believe that the State must realize the positive benefits of this program and in turn find ways to continue the funding of it. If not, teachers believe that they will possibly be less effective in the classroom and that in response, students will suffer academically.

Providing More ASIM Laboratory Kits

Although teachers reported that they enjoyed the ASIM modules and the fact that they assisted in their students being more engaged in learning, they were displeased with the number of prepared kits they received. The module limitations, as expressed by the participants, made it difficult to incorporate small cooperative groups learning. Bonnie stated that one of the greatest

concerns of the ASIM program was the idea of having enough modules and the timely delivery. Participants reported that teachers do not have the number of kits needed to conduct a class exercise. Kits sometimes have missing items because of lack of care from other colleagues. One teacher was quoted as saying, "Concern was raised about teachers not cleaning equipment after use before passing lab to next user… basically, professional accountability." A differently teacher said, "Teachers who do not help maintain equipment should not be allowed to continue checking the modules out." Teachers felt that this type of practice was somewhat unfair to their colleagues and the facilitators. Most of the teachers felt that the facilitators were already over worked and short handed.

The study revealed that teachers and facilitators shared some common beliefs and concerns when it came to the ASIM experience. Increased teacher confidence and active student engagement were items that stood out more so than others. Both the facilitators and teachers believed that the experience was a piece of the puzzle that could be a vital component to teachers' classroom instructional practices. Moreover, they both shared concerns over future funding of the ASIM program and its impact on new teachers.

Implications of Research

Six implications were derived as a result of the data collected and analyzed in this study. They included the following:

In order for teachers to be more effective in meeting standards and for meaningful learning to occur, teachers must have the ability to apply theoretical knowledge into practical classroom knowledge that reaches all children with various learning styles. Facilitators provided by the ASIM program assisted teachers through this process by preparing them through direct

hands-on training. Shulman (1986) found that teachers must deliver content that addresses all learning levels and present ways to solicit student engagement.

Based on participants responses, when teachers are afforded continued, quality professional development they become more proficient. Suporitz and Turner (2000) concluded that participation in workshops that are of tremendous quality causes superior classroom teaching.

Teachers who participate in the ASIM professional development experience are more confident in their instructional practices, more knowledgeable of biology and chemistry subject areas and the use of hands-on teaching modules. Because ASIM modules are delivered to the teachers upon scheduled request at no cost, teachers reported that they included more lab activities than before the ASIM experience.

In order for teachers to continue to receive the quality professional development training provided by ASIM, the State must find ways to financially support and implement the program as fully intended. Establishing more master sites and facilitators will afford new and veteran teachers the opportunity to share and receive the same rewarding benefits as those who have previously experienced the ASIM training.

Teachers strongly believed that students who were taught with ASIM modules appeared to be better at critical thinking. They are more excited about learning and are more actively engaged in cooperative learning activities. In fact, Anderson (1997) stressed that profound comprehension of science is viewed through student-centered instruction.

Changes in the instructional strategies and classroom practices occur as a result of continuous and meaningful professional development. The importance of ongoing professional

development is most beneficial to teachers when petitioning for instructional modifications (Garet et al., 2001).

Recommendations for Future Studies

This study focused on the perceptions teachers and facilitators had about the ASIM professional development experience and its impact on teachers' instructional practices. In addition, the study revealed the strengths and limitations according to teachers and facilitators. The following recommendations are suggested for future research.

Future studies should include representation from a larger geographical area. With a more diverse population, the researcher will be provided with more detailed knowledge of teachers' perception about the ASIM professional development experience. In addition, future studies should consist of a larger population of ASIM facilitators throughout the state. The inclusion of more facilitators allows for more in-depth insight and add validity to the facilitators overall perceptions of the ASIM training.

Future studies should include not only biology and chemistry teachers but should also be inclusive of physics teachers who have gone through the ASIM professional development training as well. Also, future studies should include a larger group of teachers and facilitators to participate in the focus group interviews.

With regard to data collection, future studies should consist of a survey to be administered to students. This survey should be used to gauge students' perceptions of their usage of the ASIM modules. Finally with regard to student impact, future studies should include an experimental design or study that would measure student achievement. Additionally, future studies should be conducted to determine if the ASIM instructional modules have an impact on the Alabama High School Graduation Exam (AHSGE) results. Students must successfully pass

the biology portion of the AHSGE before graduating from high school. The exam is administered for the first time in the 10th grade.

Conclusion

Completing this study was very beneficial for me as an educator, my colleagues, and the students we work so tirelessly to serve. This study focused on how teachers and facilitators perceived the ASIM professional development training and the impact it has on teachers' instructional practices. A study was conducted on the ASIM modules, and the conclusion from the study was that teachers and facilitators appeared to present a positive attitude towards the ASIM program. Teachers and facilitators repeatedly reported that because of the ASIM professional development experience, teachers were more confident in their instructional practices. They also reported that being trained by a biology or chemistry specialist made the implementation of the ASIM modules simple.

A great deal of responsibility has been placed on the shoulders of educators to find ways in which to increase student achievement. Findings from research have revealed that on-going quality professional development alters teachers' instructional practices. Meaningful professional development like the ASIM experience is crucial for the future of education in the State of Alabama. In order for teachers to continue to receive quality professional development training, state and local agencies must find ways to properly fund the ASIM program in the future.

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APPENDICES

Appendix A

Institutional Review Board Request

IRB Project #: 10-OR-257

UNIVERSITY OF ALABAMA
INSTITUTIONAL REVIEW BOARD FOR THE PROTECTION OF HUMAN SUBJECTS
REQUEST FOR APPROVAL OF RESEARCH INVOLVING HUMAN SUBJECTS

I. Identifying information

	Principal Investigator	Second Investigator	Third Investigator
Names:	Linda D. Burruss	Dr. J. Stallworth	
Department:	Secondary Ed., C&I	Secondary Ed., C&I	
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Title of Research Project: Exploring Professional Development Experiences: Teachers' and Facilitators' Perceptions of Alabama Science in Motion

Date Submitted: June 16, 2010
Funding Source:

Type of Proposal ☒ New ☐ Revision ☐ Renewal (Please attach a renewal application) ☐ Completed ☐ Exempt

Please attach a continuing review of studies form

Please enter the original IRB # at the top of the page

UA faculty or staff member signature: _____

II. NOTIFICATION OF IRB ACTION (to be completed by IRB):
Type of Review: _____ Full board ___✓___ Expedited

IRB Action:
___ Rejected Date: _____
___ Tabled Pending Revisions Date: _____
___ Approved Pending Revisions Date: _____
✓ Approved-this proposal complies with University and federal regulations for the protection of human subjects.
Approval is effective until the following date: 6-15-11 e.s
Items approved: ___ Research protocol (dated_____)
___ Informed consent (dated_____)
___ Recruitment materials (dated_____)
___ Other (dated_____)

Approval signature _____ Date 6/16/2010

Appendix B

ASIM Biology/Chemistry Questionnaire

The purpose of this survey is to determine what you do in your science classes and what your perceptions are about the biology/chemistry component of the Alabama Science in Motion (ASIM). Your participation is voluntary and your responses will be kept confidential. This information is being collected for a doctoral dissertation at the University of Alabama and is not part of the ASIM program. Please respond to the following items by circling the number that best matches your perceptions of ASIM biology/chemistry training.

	Strongly Disagree	Disagree	Agree	Strongly Agree
	1	2	3	4

1.	Training at the ASIM Summer Institute prepared me for successful implementation of the biology/chemistry activities.	1	2	3	4
2.	Participation in hands-on learning activities at the ASIM Summer Institute was important for successful implementation of the biology/chemistry activities.	1	2	3	4
3.	I feel confident in my ability to manage the ASIM biology/chemistry modules when implementing the activities.	1	2	3	4
4.	As a result of the ASIM training, I spend more time facilitating group activities with my student than before the training.	1	2	3	4
5.	I feel comfortable asking the ASIM facilitator to work with me.	1	2	3	4
6.	I teach hands-on science more often now that I have the ASIM modules.	1	2	3	4
7.	The modules provided by ASIM are adequate for the implementation of the ASIM biology/chemistry activities.	1	2	3	4
8.	The learning needs of students of various abilities can be met through ASIM biology/chemistry activities.	1	2	3	4
9.	I find enjoyment in teaching biology/chemistry using the ASIM modules that are delivered to my school.	1	2	3	4
10.	The learning modules assisted me in the implementation of the standards on the science portion Alabama Course of Study.	1	2	3	4
11.	The management of the ASIM biology/chemistry modules is challenging for me.	1	2	3	4
12.	The materials included in the ASIM biology/chemistry modules meet my needs.	1	2	3	4
13.	Training at the ASIM Summer Institute covered the content knowledge and pedagogy necessary for implementing the activities.	1	2	3	4

14.	As a result of the ASIM training, I include more hands-on activities than before the training.	1	2	3	4
15.	As a result of the ASIM training, I include more effective questioning during biology/chemistry instruction than before the training.	1	2	3	4
16.	I believe that teaching with the ASIM materials has been beneficial to my students' understanding of biology/chemistry.	1	2	3	4
17.	Because of the ASIM training, I am more effective as a biology/chemistry teacher.	1	2	3	4
18.	My students show an increased interest and motivation to learn biology/chemistry when participating in ASIM activities	1	2	3	4
19.	Overall, I think ASIM promotes an effective way to teach biology/chemistry	1	2	3	4

SHORT ANSWER QUESTIONS

1. On average, how many ASIM biology/chemistry activities do you us in your science class per week? _____

2. How has your teaching of biology/chemistry changed since you attended the ASIM Summer Institute?

   _____
   _____
   _____
   _____

3. What are the greatest strengths of ASIM modules?

   _____
   _____
   _____
   _____

4. What are the greatest limitations faced with the ASIM modules?

   _____
   _____
   _____
   _____

5. What do you see as areas for improvement in ASIM modules?

   _____
   _____
   _____
   _____

6. Briefly describe how you have implemented the ASIM biology/chemistry modules and kits in your classroom.

_____
_____
_____
_____

Demographic Information:
Grade level(s) you currently teach biology/chemistry 9 10 11 12
Number of classes of biology/chemistry you teach each day: _____
Number of days you teach biology/chemistry each week: _____
Highest degree: Bachelor's Master's Specialist Doctorate
Years of teaching experience: _____
Number of years you have been using ASIM modules: 0 1 2 3 4 5

Appendix C

Focus Group Interview Questions

ASIM TEACHER INTERVIEW QUESTIONS

The purpose of this interview is to explore what you do in your biology/chemistry classes and what your perceptions are about the Alabama Science in Motion (ASIM) Experience. Your participation in this interview process is voluntary and your responses will be kept under strict confidence. This information is being collected for a doctoral dissertation and is not part of the ASIM program.

1. Briefly describe what you see as the most useful professional development you have ever attended. Describe the usefulness of the training within your classroom.
2. As a result of your ASIM training, do you implement more hands-on biology/chemistry lessons than did before the training? Explain.
3. Describe the greatest strengths of the ASIM training as part of your professional development.
4. In what ways have the professional development provided by ASIM impacted your attitude about teaching biology/chemistry?
5. How has the ASIM professional development training changed you as a teacher?
6. In your opinion, what changes should be made to the ASIM training to provide more effective professional development for teachers?
7. Describe the greatest limitations faced with the utilization of the ASIM classroom modules?
8. Are there any other comments you would like to share about the ASIM institute as it pertains to biology/chemistry?

ASIM TRAINER INTERVIEW QUESTIONS

The purpose of this interview is to explore what your perceptions are about the Alabama Science in Motion (ASIM) Experience from a trainer's view. Your participation in this interview process is voluntary and your responses will be kept under strict confidence. This information is being collected for a doctoral dissertation and is not part of the ASIM program.

1. Briefly describe what you see as the most useful professional development you have ever attended. Describe the usefulness of the training within your classroom.

2. As a result of your ASIM training, do you feel teachers implement more hands-on biology/chemistry lessons than did before the training? Explain.
3. Describe the greatest strengths of the ASIM training as part of your professional development.
4. In what ways have the professional development provided by ASIM impacted the attitudes of teachers?
5. How has facilitating the ASIM professional development training changed you? How has the training changed teachers and what observations have you noticed in the teachers you service?
6. In your opinion, what changes should be made to the ASIM training to provide more effective professional development for teachers?
7. Describe the greatest limitations faced with the utilization of the ASIM classroom modules?
8. Are there any other comments you would like to share about the ASIM institute as it pertains to biology/chemistry?

Appendix D

Open-Ended Responses

What are the Greatest Strengths of the ASIM Modules?

Accessibility of Materials/Hands-on Activities/Instruction

- Ease of Access
- Availability of materials
- Delivery of the entire module and materials
- Organization and flexibility
- Equipment is ready to go, instruction and keys are ready to go
- Materials available that we could not afford to buy
- Having materials even when the school has limited funds
- Materials delivered, organized, everything is in place
- Materials and supplies – all the supplies are present for the entire class to complete each lab
- The modules are standard based and interesting to students. I can implement more labs and activities since the kits contain the necessary supplies
- Ease of use and materials prep
- Hands-on activities
- Comprehensive and make labs easier to teach
- Access to expensive materials such as spectrophotometers and electrophoresis
- Just having access to these modules would be one of the greatest strengths
- If not for ASIM, I would not be able to offer many hands-on activities to my students
- These modules apply to my course of study and help students take what they learn in the classroom and put it into use with activities that reinforce learning
- The hands-on experience that the students receive
- Less prep time
- Convenient, accessible, tremendous time-saver, provides the student a hands-on approach to the biological or chemical concept, modules bring science to life
- Materials paid for, materials delivered, pre-labeled technology not otherwise available designed to completed in 45-50 minutes
- The physics modules provide the student with the ability to take very good data. Often times, its data that would be difficult to collect otherwise
- Providing complete materials for use of modules
- Ease of use, not having to gather materials
- More activities
- Access to computer technology, convenience
- A hands-on integration and application via simple model systems
- AHSGE correlations, ACOS correlations, cost effective
- They address standards and topics in a fun and innovative way. Also, the materials are provided in an organized fashion
- Materials

- Helpful with kids with learning disabilities
- Content and Instruction
- Incorporating activities that actually help with teaching a particular subject
- Hands-on activities
- Labs that correlate with the Alabama Course of Study objectives. No cost to create and replenish labs
- Step-by-step processes
- Hands-on learning
- Valuable materials and lab experiences that would be virtually impossible for science teachers to provide for their classes, with no classroom supply monies
- The modules are all formatted the same and comes with all the equipment
- The way the modules provide a hands-on learning experience for the students
- The modules aren't too difficult for the students I teach
- Ease of use, meet standards, motivate students
- Resources
- Content standard review
- Giving quality lab opportunities to students who otherwise wouldn't have the opportunity to use this material and equipment
- The hands-on opportunities for students
- Instruction, training, and equipment
- Content based labs that meet graduation exam criteria
- They cover the Alabama State objectives
- The provide a different outlooks to similar problems
- Everything is very well thought out. If there are problems they will allow the teachers to make comments on sheets to be returned with the labs. Also in the summer training program, we teachers had to train on every lab and make suggestions that would be incorporated into improving them
- Self-contained, and everything is ready to use
- All materials are provided
- They allow materials to be used that we do not have at our school
- The kits are complete – you don't have to worry about gathering materials. Teachers can use all or part of a lab activity according the classroom needs
- Motivates students
- All linked to the course of study and everything is prepared for me
- Pre-packaged, standard driven, research based instruction, nothing is weak about that
- Correlation to ACOS content Standards
- The quantity of various labs allows the teachers to pick and choose which labs will best benefit our students and our schedules. Time saving and content oriented
- The activities coincide effectively with state and national standards. In addition, they are leveled to correspond with teaching AP courses
- Comfort and ease of availability of materials

Support

- Support
- Trainer helps with teaching too
- I love having Mrs. Doe teach some of the labs that I do not feel comfortable with
- Training makes them easy for teacher to implement and allows the teacher to provide materials and support not readily available to a teacher without ASIM training and privileges
- Providing training for new chemistry teachers
- Assistance provided by ASIM Biology Specialist

Equipment and Financial Resources

- The ASIM modules are "all inclusive" and provide equipment that our school could not afford
- Allows for activities and equipment that could not be provided by one school
- All the materials are there, with no monies and being in a small school it is often impossible to do hands-on activities without the ASIM Modules
- Students can use equipment that we cannot afford
- Saves the school money and time.
- The equipment collects the data, allowing the students to put more effort into analysis
- The students enjoy using the software and the equipment

What are the Greatest Limitations Faced with the ASIM Modules?

Scheduling/Delivery/ Availability

- Scheduling to receive modules
- Not being able to get them when needed but only occasionally
- Scheduling
- Scheduling them with in a timely manner with other schools
- High demands
- The amount of resources available to cover so many school systems
- Unavailability
- Although most of the time, I can get the module when I need them, sometimes the more popular modules one has to wait longer
- I see delivery as the greatest limitation
- It is sometimes difficult to get the more popular modules when I need them since other teachers may have reserved them ahead of me. Also, at times teachers keep the modules past their reserved time
- Not having enough lab sets
- Not enough labs
- Their time frame. Scheduling conflicts are a major problem, now more than ever
- Many schools are in need of the modules and have to share them

- Due to cuts in personnel of ASIM the delivery comes only once every two weeks. This makes it harder to plan and make sure that I have the modules that I need when I need them
- Having to complete the modules by a certain date instead of having them for the entire year
- Not always available the days you would like to use the modules, forces you to plan ahead
- Scheduling delivery of popular modules
- Having to wait to use some labs or equipment
- Scheduling – sometimes another school is using the equipment I need
- Difficulty to schedule far in advance
- Module availability
- Not enough to go around to each teacher. We need more sets
- Sharing with other teachers
- It is sometimes difficult to get a particular lab when it is really needed, but that is only because it is one that is used by most teachers. That would happen in any program … and some of that has to do with planning on the part of the individual teacher
- Not being able to get the module the week that I need it because of limited supplies
- The only limitation I can think of is the number of "kits" available. Depending on the topic being taught, it was hard to receive the kit if it was wanted by many other teachers
- Availability
- Supplies and materials
- Scheduling labs for two weeks at a time. The labs are tied up to long at a particular school
- Not having enough supplies for each student to have their own materials and work individually
- Limited by schedule
- Not having them delivered on time or not at all. Sometimes not all of the materials are usable. I was unable to receive some of the labs until the end of the year because of the high demand
- You have to wait if another teacher is using the modules and if you aren't a great planner, then you just get it when you can
- Availability of modules when needed
- Although I've not had a problem, I can see where scheduling could become a problem the more involved school systems become ASIM and LTF
- Scheduling equipment and additional training
- The ability to receive the modules in a timely fashion
- It is often difficult to schedule use of the equipment at the point in the school year that it best fits into my lesson plans
- Sharing usage with other schools
- Frequency of delivery
- Not enough supplies to go around. There is often conflict with popular modules and we have to play a waiting game
- Scheduling

Equipment

- Need to be updated
- Equipment needs to be updated often
- Updated technology
- Need new Geiger Muller Tubes
- Need top loaders measuring to 0.01g for Accuracy and Precision Lab
- Teachers not cleaning equipment after use before passing lab to next user (professional accountability)
- Funding
- Funding and the agendas of the political party du jour already hinder the training and support for the ASIM program
- Lack of money
- Training opportunities (funding)
- Money and staff….the one facilitator is a very, very busy person and labs are limited by monetary constraints
- Maintaining the modules in excellent condition is an ongoing challenge and having funds available to replace broken or damaged equipment when the need arises
- Jan Doe does an excellent job! Having funding for her to visit schools and do the chemistry demos once a semester (liquid nitrogen, etc)
- Lack of funding for this program
- Lack of funding that might have given them more to work with in some areas

Instruction

- There is so many labs, it is difficult to choose which one to use
- Extensions – graphing, data analysis
- Some of the modules are not geared toward higher level classes
- Need kits longer at the schools for Pre-AP year long courses
- There were a few areas where there could have been labs and weren't
- Many are cookbook labs

Time

- Time (as with all things)
- Squeezing some of them in to 48 minutes classes
- Time
- They are time consuming
- Many are too long to be completed in one class period
- Time is the greatest limitation
- Time is a factor for me since I am on the 52 minute period. Some labs require two classes
- Trying to help others see that instructional time should be protected
- The ASIM Biology specialist services a great variety of teachers so her time and resources are more limited than that of the Chemistry or Physic specialist. At my school alone our one

Biology specialist provides labs for 5 different teachers teaching six different sciences while the Chemistry and Physics specialist both see only one teacher at my school

What do you see as areas for improvement in ASIM modules?

Instruction

- Add more upper level modules; Anatomy and Physiology, AP Biology/Chemistry
- More activities for lower level classes
- Having more of the same modules to go out on the most popular ones
- There are some great activities included in the ASIM program that are not available in my particular service area. We need to have a broader selection of activities available in our area (UAB)
- More labs
- Some of the instructions could be rewritten into more understandable language for students work struggle with reading comprehension. Often the instruction seem to imply prior knowledge that my students do not always have
- Some of the procedures have (or had the last time I used them, 3 years ago) errors that need to be corrected
- Some of the Physic labs are very wordy. The kids are bogged down with reading so much
- Expand lab offerings to Physical Science and Geology
- Increase the number of activities or at least variations
- More sets
- Needing more modules
- Addition of more Anatomy and Physiology activities
- The level of questions for the lab summary
- Changing to more inquiry based labs
- I would like to see more of the activities designed as open-ended labs
- It would be nice to see some more audiovisual materials included with the kits
- More kits… love teaching laboratory work
- Inclusion of more higher level labs
- Increase in variety of labs over the years

Equipment

- Teachers who do not help maintain equipment should not be allowed to continue checking the modules out
- Individual professional accountability of teachers
- Accuracy and Precision – always order the correct type of balances; Top loaders to the .001 and Analytical to the .0001. Nuclear Scalars need to be updated
- More equipment available
- Equipment need to be updated periodically
- Keep the kits in top working order… the ASIM Project Director need assistants who do ONLY that

- Multiples of labs and equipment is needed for the teachers to use. We as teachers have an increased need for the labs, but there are not enough for everyone to use

Training/Trainers

- More access to training
- More summer training
- Get rid of people who do not want to work with you and make scheduling more practical to the teacher. Stop treating teachers like we are idiots and allow us to use labs without having to be trained on things such as a microscope. That is insulting to a teacher like me who has a degree in Professional Biology
- Having more support so that fewer schools have to be represented by one ASIM Director
- More interaction with the ASIM facilitator
- Be able to train more teachers
- More ASIM facilitators, that would be able to spend more time in the class to help complete a lab and they would have more time to deliver the labs to different teachers
- More one-on-one time during training
- More streamlined training
- The need for better training. The training I received was too crowed for all to access the materials. I did not receive any hands-on training
- I feel we need additional Biology specialists to meet the needs of the teachers. I also feel that the Chemistry and Physics specialist should develop labs specifically for the Physical Science curriculum and provide training for those Physical Science teachers
- We need training back – this summer was the first time we didn't have institute. Also, more supplies and more drivers to help with runs

Funding

- More state and national funding
- More money on the program
- Funding should be provided by the State Department to continue Summer Institute

Availability/Delivery

- Availability
- More modules availability of each kind so they can be more readily available
- Having more modules of the popular labs available for use by more teachers
- Delivery

Time

- More time for implementation
- Shorten the time the activity requires

How has your teaching of Biology/Chemistry changed since you attended the ASIM Summer Institute?

More Hands-on Activities

- I have included more labs
- I have available equipment so I can do more hands-on
- I am able to implement more advanced labs because of access to equipment/materials I would not be able to purchase
- More hands-on
- I use many more hands-on activities than before
- More hands-on activities to supplement the content area
- More activities used because more supplies available
- I have always used hands-on teaching, but the ASIM modules make it easier as I do not have to purchase everything I need to do more hands-on
- I have a greater variety of activities to choose from when designing my lesson plans
- I use more hands-on activities since the ASIM kits reduce the amount of preparation needed. I make an effort to include more opportunities for students to create charts and graphs to communicate their results
- Nothing really changed, just allows for a few extra labs
- More hands-on lab and simulations activities
- I am able to give students greater understanding of the topics covered
- Less pressure on me doing labs
- I spend more time doing labs that I could not do otherwise
- My students are more active in their learning of scientific concepts
- I am more aware of misconceptions that students bring to class with them and ways to address and restructure those misconceptions
- I include more hands-on activities because they are readily available
- More hands-on activities
- More hands-on activities
- Implement more hands-on activities in class. The students also retain more information due to the creation of memorable experiences
- I use more labs and inquiry based learning strategies
- I have access to more hands-on activities
- The students have actual hands-on labs and technology to use that they otherwise would not have
- My teaching is more interactive with the students
- I've done more hands-on activities than ever before and the students get a better understanding
- It has increased the use of hands-on activities for students
- Students are engaged more in the lesson
- I am able to ask more in-depth, higher order questions in my classes, because my students have the necessary tools available to them to be able to address the questions. However, I have always been a "projects" teacher, so my teaching has not changed that much. I have

always wanted to know the whys and hows… so it is only natural that I establish an environment that allows my students to do the same and to discover the answers for themselves, with my guidance
- I can incorporate more labs
- I have been able to introduce the materials by lecturing first then reinforcing the material using the labs provided by ASIM
- More hands-on and more inquiry learning
- Interactive
- It has allowed my students the opportunity to have more hands-on material that we wouldn't be able to have without Science in Motion
- Provided new lab activities and equipment previously unavailable to my students (Analytical Balances and Geiger Muller Counters)
- I am able to provide more hands-on opportunities for my students
- My students have a better understanding of information after hands-on activity
- I added the lab portion
- I have more patience and I'm more hands-on with my students
- Added more labs
- More inquiry
- I have incorporated the kits into my existing curriculum where I once didn't have an activity
- I am able to do more with students because I can get the kits
- I use some of the Chemistry labs
- I have use hands-on lessons requiring students to work collaboratively to address problems/questions since I began my teaching career. I have modified several of the ASIM labs to better meet my students' needs
- I am better prepared to teach using hands-on methods due to support from ASIM
- I teach less and facilitate more. I question my students and look for understanding. They take charge more and have learned to rely on me less and less for answers
- It has allowed me to integrate more labs into my curriculum. It has also reduced my out of pocket expenses to provide labs to my students
- Incorporation of more, innovative lab materials

<u>Resources</u>

- I am confident, and I have more resources at my fingertips
- It is better
- ASIM Summer Institute increased content knowledge, increased by confidence to use labs in the classroom, and challenged me to re-think the way I teach certain topics
- Better time management
- Brings science to life! Makes it real!
- I can better field questions solve problems that may arise
- More tools
- More confidence and less stress related to lab materials, set-up, and procedures
- Very well rounded with the latest lab exercises
- More effective

- I have a lot more resources available to me for my students to use
- I have more resources
- Without the training and the equipment, we would not be able to have many of the lab experiences because of lack of equipment
- Made me more aware of what was available to do as "hands-on" labs
- More confident with lab implementation
- Summer Institute has enhanced my confidence so that I try to have a lab at least twice a week for students

Briefly describe how you have implemented the ASIM Biology/Chemistry modules and kits in your classroom.

Biology Implementation

- I use at least one module per testing unit in biology
- Biology this year – some I have made up the kits myself, using ASIM instructions
- Using DNA electrophoresis unit as well as dissecting microscopes
- I use many of the genetics modules in my Biology class when teaching that section of the course
- Biology kits used for Biology, Environmental Science, and Zoology applications
- I use the biology modules to give students some hands-on experience with the material we study. Usually the entire class is working on the lab/activity at the same time. Students work in groups. I am forced to use larger groups than those recommended in the lab/activity due to larger class sizes
- I use the ASIM modules in almost every unit that I teach in Biology and often I use more than one. Within Chapter 1, I use the Toilet Paper Strength Lab, the Obscertainers Lab, and the Country Metric Olympics Lab
- I use ASIM modules to begin or introduce a new biological concept. Or I use the modules to reinforce concepts that I have taught. The modules provide input on students misconceptions
- Biology: even subject level in Biology -- I use these labs all the time…. Saves me money out of my personal pocket – science teachers spend a lot of personal income to provide experiences to their students. Thank you ASIM for helping us. When those you should do not

Chemistry Implementation

- I do not really use ASIM in chemistry
- I have integrated the ASIM modules into my Chemistry curriculum in such a way as to give students experience with a concept before teaching the concept itself
- Chemistry, in lieu of designing my own labs modules always selected to support academic topics covered at that time
- I use 1-2 kits a week in my Chemistry class. They are great for my Chemistry class and my IB Chemistry class. I can use them as is or adapt them to be a little higher level needed
- I use the ASIM kits for labs in Chemistry I, II, and the AP courses. Often the ASIM facilitator helps with the AP Chemistry labs as he was once my Chemistry Professor in

college. I use ASIM modules either to begin a topic, or conclude a topic. The labs become another way to access students' scientific abilities

Biology/Chemistry Implementation

- I use them continually
- I do not currently use them
- Use them (?)
- Our lab investigations center around the key themes outlined in the state course of study which mesh well with ASIM modules
- Hands-on labs activities with manipulative and worksheets, video with worksheets and activities
- We use them to reinforce AHSGE objectives
- I use them to further demonstrate a particular concept being used in class. Sometimes I modify the experiment depending on what class and grade level I am teaching
- Used to reinforced
- I use them most often to reinforce content. I also use them to help discover content
- I use the kits to improve the understanding of topics throughout the text
- I have included some ASIM labs that I did not previously do with my classroom
- I use them in my IB classes on a regular basis. I use them to help reinforce subjects that are covered in class as well as using them for inquiry-based learning
- I have a schedule of activities that I request from ASIM based upon the timeline in which I cover information in my classes When delivered, I prepared all necessary materials and have my students conduct the activity/experiment using the supplies from the modules
- As concepts are discussed, the labs are used as reinforcement and sometimes the labs are used as introductions, and then we go back and discuss the concepts associated with the labs
- Use one-two per content standard
- I use many labs that go along with the content in the course of study
- Basic
- My students do the following experiments: Evaporation and Intermolecular Forces, Melting Points, Freezing Point Depression, Fractional Distillation, Preparation of Aspirin, Esterification
- Hands-on application weekly corresponding to content mastery
- Only about once – difficult to schedule
- Pre-lecture labs, concept reinforcement
- I use them to solidify difficult concepts by inquiry-based, hands-on learning
- I use kits in lab
- In a typical week I will at least one lab activity to reinforce content; usually the lab(s) I use will be delivered from my ASIM facilitator or I will use the write-ups from the ASIM website and provide my own materials if I have them
- Modules are implemented according to COS standard that needs to be covered
- I use them as full-fledged labs and sometimes for demos
- Lab, demonstration, technology

- After covering a specific topic. I would use a kit that helps to demonstrate what was discussed
- I utilize the ASIM modules to help students who are kinesthetic and/or visual learners to grasp a better understanding of concepts
- Modules and kits are implemented into every content standard as an introduction of review
- I use the labs has a follow-up and reinforcement of the content information that has been taught
- To accent the other materials
- I use the labs to primarily teach the AHSGE objectives
- They help illustrate every standard
- We always complete at least one module a week that correlates with lesson being taught
- I use the kit as reinforcement. After the students have been introduced to the lab, they use the kits for reinforcement
- Hands-on inquiry learning
- Support classroom instruction or introduce new concepts
- Providing group activities
- We use the kits as hands-on material that is used for review of material that has been taught earlier in the week
- Providing lab activities to supplement my own program
- The materials are implemented during small groups
- I have coordinated my lessons based on course of study and AHSGE criteria. Each unit includes a science in motion activity. I send a calendar with these activities to my Biology specialist and she is very prompt and attentive to all science questions and needs
- I use Protein Synthesis, Chromatography, Photosynthesis, DNA extraction, and others
- To reinforce concepts
- I encourage kids to become more involved and they are in turn more creative thinkers
- I use them in one or two ways; I either used them to launch a new chapter or to reinforce new material that needed to be taught first
- Used various labs
- Some labs I allow the students to complete - - others, I use as demonstrations
- As reinforcement of concepts after lecture
- I've added them where I didn't have the equipment or activities in place
- I work the labs into my curriculum
- I have used a variety of these over the years to help with student understanding of textbook materials
- Use it in all my lab courses
- We use them about 3-4 times per week
- After working for several days to learn the identifying markings on the skeleton, students experience their first lab practical using the disarticulated skeleton
- I select the activities that best correlate to the course of study standards and try to include one lab per chapter
- My students receive the directions and take them home to record the purpose, materials, hypothesis (one they construct), and procedures into their lab composition books. They come back and we discuss for ten minutes the lab and they ask questions. We then enter the lab and

conduct the experiments. We wrap up our data for the class and they then take their logs book home to complete the lab report. The data sheets are due at the close of lab. We do it this way everything. Students like structure

- I have incorporated one or more labs into each of my units that I teach for all three of my science courses
- Doing science helps with ELL and inclusion classrooms more than teacher guidance only
- I use all the advanced labs for AP
- Use in labs to increase hands-on approach

Appendix E

Focus Group Interview Responses

Teacher Responses:

1. Briefly describe what you see as the most useful professional development you have ever attended. Describe the usefulness of the training within your classroom.

    a. Any professional development that involves hands-on, inquiry learning is a plus as far as usefulness to me. We, as teachers, are expected to employ inquiry-based learning in our classrooms and sometimes it is difficult to do that if it has not been modeled for us.

    b. The most useful professional development I have attended is the Alabama Science in Motion training I received in the summer of 2007 and 2008. There, I learned about different labs (hands-on lessons) that could not only assist my hands-on learners, but also help students to apply what has been learned through a hands-on experience. The training was useful in that I was trained to encourage students to read and follow directions, assist students with executing labs, and promotes students to answer higher-order thinking questions.

    c. The most useful professional development that I have attended was the College Board AP Environmental Science training in Knoxville, TN. This was useful because it provided a guide for teaching the class to proper rigor. The workshop was well organized and provided a colligate environment among the educators present. This was achieved through discussions, field trips, and social events.

    d. The most useful professional development that I have attended would be a workshop on teaching punnett squares/karyotypes. This workshop was useful because I use this lab in all my classes, it is an excellent method to reinforce the concept of punnett squares, genetic make-up, a way for the students to see if there is an abnormality with the offspring, and an opportunity for students to determine the sex of the offspring.

    e. The most useful professional developments that I have attended are the AMSTI and LTF trainings. These trainings were the most useful because they focused on the main aspect of my classroom- hands on learning. These trainings allowed me to experience the activities for myself and it allowed me to participate as the students would. The ASIM trainings were also useful because they provided me with the materials to facilitate the hands-on learning activities.

    f. I would have to say attending the ASIM training was by far the best professional development training I have ever attended.

2. As a result of your ASIM training, do you implement more hands-on biology/chemistry lessons than did before the training? Explain.

a. Because of ASIM training, I definitely implement more hands-on biology/chemistry lessons than I did before attending training. There are some labs that I have used in my classroom only after I attended the biology or chemistry sessions during the summer. The ASIM training during the summer gives me a chance to do the lab with an instructor present, so I can ask questions and be comfortable performing it on my own, with my students.

b. I definitely implement more hands-on biology lessons than before I went to training. Before training I only had labs that were provided by the textbook or textbook resource books. These labs proved to leave my students uninterested and required money to purchase materials. It didn't take long before I cut out all labs due to the lackluster responses of students when told that we would do another lab. Now, with the help of Alabama Science in Motion, students look forward to labs and ask when they will do another. The labs are challenging and apply to real life situations in biology which give the students purpose.

c. Yes. Based on the fact that the materials are provided with the modules, it makes it more convenient to perform the labs without them being a financial burden for the teacher.

d. I was able to provide more labs and vigorous activities for my students as a result of participating in science in motion. This program is essential for schools that do not have the resources to provide lab opportunities.

e. Yes, science in motion is a good reinforcement to the concepts that I have taught. It is a good way to reach kinesthetic learners. It is really easy on the teacher as well, with all the material already provided for you; why not implement more hands-on activity.

f. Most definitely! It has been awesome having lab kits that correspond directly with the ALCOS and the standards that are presented for the AHSGE. I don't know what I would do without the opportunity afforded.

3. Describe the greatest strengths of the ASIM training as part of your professional development.

a. The greatest strengths of ASIM training would be the hands-on aspect, as well as the ability to receive ready-made labs, delivered to your classroom when you need them.

b. There is a great push in education to implement more challenging, higher-order thinking questions. Alabama Science in Motion hands-on lessons asks students these higher-order thinking questions. Through training I was told to not only have students answer the questions given through the lesson, but also supply students with challenging questions of my own before, during, and after the lab (hands-on lesson). ASIM training also opens up dialogue with other teachers. This allows teachers participating in the training to share their ideas on different methods to present and perform the labs. I have also learned of different enrichment activities used by other teachers that can be utilized in my biology class.

c. The greatest strength based on my experience with ASIM is the actual hands-on training. The hands-on training provided with ASIM allows me the opportunity to complete the activities before my students so that I can see how the lab activity should be performed. It also allows me the opportunity to troubleshoot and work out any potential problems that the students may encounter with the activities.

d. The greatest component of ASIM is training teachers systematically with hands-on activities.

e. The fact that I am able to refresh my scientific skills and techniques during the summer and meet other colleagues to exchange ideas, in my opinion is the greatest strength of ASIM training.

f. I feel that the greatest strength of the ASIM training is the fact that it supplies teachers with the necessary tools to instruct properly. Not having to worry about funds is the sweetest part of it all.

4. In what ways have the professional development provided by ASIM impacted your attitude about teaching biology/chemistry?

   a. The professional development provided by ASIM has impacted my attitude about teaching chemistry more so than biology, probably because I felt less confident regarding chemistry labs (or certain chemistry labs used as physical science labs) prior to attending the training. It has made me feel more confident in my ability to teach relevant material to my students.

   b. I feel more positive about teaching due to the hands-on lessons available and relationships with other teachers I now have. Through my professional development provided by ASIM, I feel that my students are getting the hands-on lessons they need and that I could not afford on my own. Through hands-on lessons, my students gain a better understanding of the material and now understand how biology applies to real life. Because of ASIM, I have also formed relationships with other teachers that are beneficial in expanding my teaching resources and learning about successful learning tools implemented at different schools that could be helpful not only in my classroom but school wide.

   c. ASIM reinforces my belief that hands-on teaching and learning offers students a better opportunity to understand science concepts. In this day and age, textbook learning is antiquated and the most conducive way to teach a concept is to perform it. Experimentation allows students to explore and act on their curiosity. It also allows them to relate a textbook concept to real-life experiences.

   d. This training has not affected my attitude about teaching Biology. I have always displayed a positive attitude about teaching biology to my students. The use of hands-on instruction is not new to me. It is has always been a part of my instructional practices.

e. It makes teaching biology fun. Instead of always being a traditional classroom, I am now able to implement hands-on activities even in a school with limited resources.

f. I do not think my attitude has changed because of ASIM. However, I do think that it has made teaching easier because it causes students to become more involved in their educational endeavors. Hands-on learning is the way to go for student interaction.

5. How has the ASIM professional development training changed you as a teacher?

   a. I don't know if I can say that ASIM professional development training has changed me as a teacher, but again, at the risk of sounding repetitive here, the hands-on training has helped me incorporate those activities/labs into my own classroom and based on most current research, inquiry learning and hands-on activities are the way most students learn best.

   b. The training has made me a better teacher because of all the ideas I have obtained from other teachers and the ASIM facilitator. When attending the training, I was able to talk to teachers and the facilitator about a wide range of subjects in teaching. I was able to learn about different classroom management methods, activities to implement reading, labs outside of ASIM, enrichment activities/projects proven useful by other teachers, and great review techniques to use with students. I have taken all that I have learned to create an educational environment that produces successful students in biology.

   c. It has not changed me as a teacher. Before becoming involved with ASIM, I performed several lab activities with my students and after being involved with ASIM I continue to perform several lab activities with my students as well as incorporate more hands-on activities as a result of ASIM.

   d. The only key change has been providing students hands-on labs without paying for them personally.

   e. Each year that I attend ASIM training, I become more confident in the material I am teaching.

   f. It has made me more confident as a teacher.

6. In your opinion, what changes should be made to the ASIM training to provide more effective professional development for teachers?

   a. In my opinion, the changes that should be made to the ASIM training that would provide more effective professional development for teachers would be to not let proration be a factor that determines whether summer institutes are offered or not, and to continually be adding new labs.

   b. I believe that we should include a training day (or half day) to become more effective in the classroom. Perhaps an open forum for teachers to express different issues in the

classroom and solutions that other teachers use that have been successful could be helpful.

c. I really don't think any changes should be made to the ASIM training at this time. It is one of the most effective workshops for science teachers and students.

d. The program should be available to more teachers.

e. If there were more funding for the program, I would encourage all science teachers to become trained in ASIM. I would also require teachers to go to the training as part of their certification renewal process to keep teachers up-to-date with the changes in science and technology.

f. ASIM should be offered to all science teachers in all areas.

7. Describe the greatest limitations faced with the utilization of the ASIM classroom modules?

a. The greatest limitations faced with the utilization of the ASIM classroom modules would be the planning that is involved on the teacher's part. It would be nice if there were more modules and such planning were not necessary, i.e., if my plans change and I need a module earlier or later, not having to wait weeks to get it. Also, for teachers who are not teaching strictly Biology or Chemistry (or even Physics) course, there are no options for them unless the person overseeing the ASIM Biology, Chemistry, or Physics portions are open to them attending the training.

b. The greatest limitation faced with using the ASIM classroom modules is sharing the hands-on lab materials with others. Other than that, I cannot think of any other limitation I have found with utilizing the ASIM classroom modules.

c. The greatest limitation faced with the utilization of the ASIM classroom modules/kits is timely delivery of the materials. I always receive my modules/kits a month or so after school begins. This reduces the amount of time I have to complete the modules/kits before I am expected to pack them up for return.

d. The greatest limitation with classroom modules is making sure all learner levels are addressed. That we meet the requirements based on the No Child Left Behind Act.

e. The greatest limitation would be, there aren't enough kits, and with so many teachers in the same area teaching the same content material it is sometimes weeks before teachers are able to use the kit for that unit.

f. The greatest limitations would be accessibility of kits. The high demands for the kits make it extremely difficult for scheduling.

8. Are there any other comments you would like to share about the ASIM institute as it pertains to biology/chemistry?

a. The only other comments I would like to share are that in the past when I have attended ASIM institute, the person in charge was much more regimental in her insistence at teachers staying until 4 p.m. to receive CEU credit for the day (as well as the stipend). Learning should be fun, especially when people are attending during the summer outside of their regular work hours. More flexible should be the norm, not the exception. This goes with the answer to question 7, also. If a teacher is teaching another science other than the ones specified in the program, they should be encouraged, rather than discouraged about attending workshops or training, especially if there are none applicable to their subject matter.

b. I think that the ASIM institute is a wonderful program. The program is very helpful to biology teachers such as me. Pre-lab activities, post-lab homework, lab power points, and lab materials are provided to enhance student comprehension. I am able to present lessons and provide activities that my students look forward to doing and go home to tell their parents about.

c. I am very concerned with the financial future of the ASIM training. With critical finances in a state of emergency, new teachers may not have the same opportunity to experience the ASIM training.

d. I must also agree with the other teacher when she said that funding is critical to the success of this professional development training. Also, I feel that teachers are much more effective in getting the instruction across to today's students when hands-on modules are utilized.

e. No response (Participant had no other responses, basically said it all in the other responses)

f. I think it is absolutely wonderful for all science teachers.

Facilitator (Trainer) Responses:

1. Briefly describe what you see as the most useful professional development you have ever attended. Describe the usefulness of the training within your classroom.

    a. I can honestly say that the most useful and relevant professional development that I have ever attended was ASIM training for Biology. Although I am currently the Biology Specialist at Alabama A&M, I was fortunate enough to have attended ASIM training as a teacher participant. I was able to immediately implement the concepts that I learned through the use of a multitude of laboratory activities. The training was truly helpful and applicable immediately.

    b. The overwhelming majority of PD I have attended as a student has been pure unadulterated crap. The best was a workshop put on by one of our equipment vendors. This training was useful in that I learned a number of "tricks" that made me better prepared to teach my teachers how to use the equipment.

2. As a result of your ASIM training, do you feel teachers implement more hands-on biology/chemistry lessons than did before the training? Explain.

    a. I absolutely believe that teachers implement more hands-on biology lessons. Moreover, many of the ASIM Biology and Chemistry lessons are being rewritten to include an inquiry based style of learning using the 5E methodology. This has proven invaluable in utilizing a style of learning in the science classroom that has been proven to be successful and impactful.

    b. Certainly, while not every teacher that has attended ASIM lab training has done MORE labs with their students but I feel all have done more high quality technology based labs than they did before.

3. Describe the greatest strengths of the ASIM training as part of your professional development.

    a. ASIM training includes many strengths. I would have to say that the networking among teachers that occurs during training is a profound benefit of the program. In addition, the program serves to alert teachers of potential professional development activities provided by other scientists and institutions. The training also provides good background information for teachers. Finally, once the teachers have completed their training, they are eligible to receive the services of the program, including the delivery of a great number of laboratory activities to their classrooms.

    b. No Comment

4. In what ways have the professional development provided by ASIM impacted the attitudes of teachers?

    a. In my opinion, teachers are encouraged by having the opportunity that is afforded them by the professional development offered by the ASIM program. They seem to be positive in their attitudes regarding the ability to offer so many activities to their students.

    b. In my mind, the major difference is that, after being introduced to ASIM training, teachers are more committed to the laboratory side of teaching science and less intimidated by the technical side of the lab environment.

5. How has facilitating the ASIM professional development training changed you? How has the training changed teachers and what observations have you noticed in the teachers you service?

    a. Facilitating the ASIM professional development has changed me in that it has given me a whole new appreciation for the teachers I serve and their dedication to their students. I have been inspired by the complete and total effort that has been extended by teachers in the ASIM Biology program. They are incredible. I believe that the training has also impacted the teachers in a positive way. Particularly in this time of proration when teachers don't even have monies for purchasing paper, the knowledge that I can bring

them the kits that they need in order to adequately cover the COS objectives seems to take a burden off of the teachers. It is manifest in their positive attitudes toward their students and daily activities. Teachers are incredibly grateful for the service provided by ASIM.

b. Leading ASIM training always teaches me something new about the labs I teach. What works well, what is a challenge, how much time does a certain step take, which instruments are hard for the students to use, etc. I think I have been able to use these observations to improve some of the labs and to improve how I teach them. Some teachers are weak in content knowledge. ASIM training helps with that. Some teachers feel intimidated by the prospect of leading labs. ASIM training helps with that. Some teachers do not seem to be affected one way or the other by ASIM training.

6. In your opinion, what changes should be made to the ASIM training to provide more effective professional development for teachers?

   a. The most obvious change that needs to be made currently is for us to have the ability to offer training. Due to proration, we were unable to offer training last summer and will be unable to do so again this summer. In an attempt to combat this lack of training, I will be working to offer some "compressed training" over the course of the second semester. This sustained training may prove a positive experience for teachers in the region.

   b. I would like to be able to spend more time on fewer labs. We have so many labs we must train on and so little time to do it that sometimes I feel we don't cover the material in enough depth.

7. Describe the greatest limitations faced with the utilization of the ASIM classroom modules?

   a. Again the limitations revolve around financial constraints. In terms of the use of kits to teach content, there are few limitations. With an influx of money, more kits could be created, allowing more teachers to be served.

   b. Limited equipment is a problem. Frequently, there are waiting lists for some of the most popular labs. If we had more inventories more teachers could be served in a timely manner.

8. Are there any other comments you would like to share about the ASIM institute as it pertains to biology/chemistry?

   a. I am an avid promoter of these programs. I know that as a teacher participant the ASIM Biology program made my work so much easier. It is my goal to make the jobs of my teachers easier by providing them as many instruments as I can to assist them in their everyday responsibilities.

   b. No Comment

Appendix F

Descriptive Information Regarding Participants' Perceptions of the ASIM

(Questions 1 - 4)

Questions	Frequency	Percentage
Q1. Training at the ASIM Summer Institute prepared me for successful implementation of the Biology/Chemistry activities.		
Strongly Disagree	1	1%
Disagree	1	1%
Agree	31	38%
Strongly Agree	49	60%
Total	82	100%
Q2. Participation in hands-on learning activities at the ASIM Summer Institute was important for successful implementation of the Biology/Chemistry Activities.		
Strongly Disagree	2	2%
Disagree	3	4%
Agree	28	34%
Strongly Agree	49	60%
Total	82	100%
Q3. I feel confident in my ability to manage the ASIM Biology/Chemistry modules when implementing the activities.		
Strongly Disagree	0	0%
Disagree	3	4%
Agree	25	31%
Strongly Agree	52	65%
Total	80	
Q4. As a result of the ASIM training, I spend more time facilitating group activities with my students than before the training.		
Strongly Disagree	2	2%
Disagree	5	6%
Agree	38	46%
Strongly Agree	38	46%
Total	83	100%

(Questions 5 - 8)

Questions		Frequency	Percentage
Q5.	I feel comfortable asking the ASIM facilitator to work with me.		
	Strongly Disagree	0	0%
	Disagree	4	5%
	Agree	20	24%
	Strongly Agree	58	71%
	Total	82	100%
Q6.	I teach hands-on science more often now that I have ASIM modules.		
	Strongly Disagree	1	1%
	Disagree	8	10%
	Agree	33	40%
	Strongly Agree	40	49%
	Total	82	100%
Q7.	The modules provided by ASIM are adequate for the implementation of the ASIM Biology/Chemistry activities.		
	Strongly Disagree	1	1%
	Disagree	1	1%
	Agree	36	44%
	Strongly Agree	44	54%
	Total	82	100%
Q8.	The learning needs of students of various abilities can be met through ASIM Biology/Chemistry activities.		
	Strongly Disagree	1	1%
	Disagree	1	1%
	Agree	41	51%
	Strongly Agree	38	47%
	Total	83	100%

(Questions 9 – 12)

Questions	Frequency	Percentage
Q9. I find enjoyment in teaching Biology/Chemistry using the ASIM modules that are delivered to my school.		
Strongly Disagree	1	1%
Disagree	1	1%
Agree	25	31%
Strongly Agree	54	67%
Total	81	100%
Q10. The learning modules assisted me in the implementation of the standards on the science portion Alabama Course of Study.		
Strongly Disagree	1	1%
Disagree	1	1%
Agree	31	38%
Strongly Agree	50	60%
Total	83	100%
Q11. The management of the ASIM biology/chemistry modules is challenging for me.		
Strongly Disagree	18	22%
Disagree	49	61%
Agree	12	15%
Strongly Agree	2	2%
Total	81	100%
Q12. The materials included in the ASIM biology/chemistry modules meet my needs.		
Strongly Disagree	1	1%
Disagree	4	5%
Agree	40	48%
Strongly Agree	38	46%
Total	83	100%

(Questions 13 - 16)

Questions		Frequency	Percentage
Q13.	Training at the ASIM Summer Institute covered the content knowledge and pedagogy necessary for implementing the activities.		
	Strongly Disagree	0	0%
	Disagree	4	5%
	Agree	34	41%
	Strongly Agree	44	54%
	Total	82	100%
Q14.	As a result of the ASIM training, I include more hands-on activities than before the training.		
	Strongly Disagree	1	1%
	Disagree	8	10%
	Agree	38	46%
	Strongly Agree	36	43%
	Total	83	100%
Q15.	As a result of the ASIM training, I include more effective questioning during biology/chemistry instruction than before the training.		
	Strongly Disagree	1	1%
	Disagree	11	13%
	Agree	45	55%
	Strongly Agree	25	31%
	Total	82	100%
Q16.	I believe that teaching with the ASIM materials has been beneficial to my students' understanding of biology/chemistry.		
	Strongly Disagree	1	1%
	Disagree	1	1%
	Agree	38	46%
	Strongly Agree	43	52%
	Total	83	100%

(Questions 17 – 19)

Questions		Frequency	Percentage
Q17.	Because of the ASIM training, I am more effective as a biology/chemistry teacher.		
	Strongly Disagree	1	1%
	Disagree	2	2%
	Agree	43	52%
	Strongly Agree	37	45%
	Total	83	100%
Q18.	My students show an increased interest and motivation to learn biology/chemistry when participating in ASIM activities.		
	Strongly Disagree	1	1%
	Disagree	2	3%
	Agree	40	48%
	Strongly Agree	40	48%
	Total	83	100%
Q19.	Overall, I think ASIM promotes an effective way to teach biology/chemistry.		
	Strongly Disagree	1	1%
	Disagree	0	0%
	Agree	29	36%
	Strongly Agree	52	63%
	Total	82	100%

Appendix G

ASIM Module Responses

Greatest Strengths of the ASIM Modules

Themes
Accessibility of Materials
• Ease of access • Access to expensive materials such as spectrophotometers and electrophoresis • Just having access to these modules would be one of the greatest strengths • Materials delivered, organized, everything is in place
Hands-on Activities
• If not for ASIM, I would not be able to offer many hands-on activities • The hands-on experience that the student receive • The way the modules provide a hands-on learning experience for the students • Convenient, accessible, tremendous time-saver, provides the student a hands-on approach to the biological or chemical concept, modules bring science to life
Instruction
• The physical modules provide the student with the ability to take very good data. Often times, it is data that would be difficult to collect otherwise • They address standards and topics in a fun and innovative way. Also, the materials are provided in an organized fashion • Labs that correlate with the Alabama Course of Study objectives. No cost to create and replenish labs

Greatest Limitations Faced with the ASIM Modules

Themes
Scheduling
• Scheduling to receive modules • Scheduling them within a timely manner with other schools

- Their time frame. Scheduling conflicts are a major problem, now more than ever
- Scheduling labs for two weeks at a time. The labs are tied up too long at a particular school

Delivery

- I see delivery as the greatest limitation
- Due to cuts in personnel of ASIM the delivery comes only once every two weeks. This makes it harder to plan and make sure that I have the modules that I need when I need them
- Frequency of delivery
- Not having them delivered on time or not at all

Availability

- Not always available the days you would like to use the modules, forces you to plan ahead
- The only limitation I can think of is the number of "kits" available. Depending on the topic being taught, it was hard to receive the kit if it was wanted by many other teachers
- Availability of the modules when needed
- You have to wait if another teacher is using the modules and if you aren't a great planner, then you just get it when you can

Areas for Improvement in ASIM Modules

Themes

Instruction

- Some of the instructions could be rewritten into more understandable language for students who struggle with reading comprehension
- Often the instruction seem to imply prior knowledge that my students do not always have
- It would be nice to have some audiovisual materials
- Changing to more inquiry based labs

How has your teaching of biology/chemistry changed since you attended the ASIM Summer Institute?

Themes

More Hands-on Activities

- I use more hands-on activities since the ASIM kits reduce the amount of preparation needed. I create an effort to include more opportunities for students to create charts and graphs to communicate their results
- More hands-on activities to supplement the content area
- I have always used hands-on teaching, but the ASIM modules make it easier as I do not have to purchase everything I need to do more hands-on
- More hands-on labs and stimulation activities
- I am able to implement more advanced labs because of access to equipment/materials I would not be able to purchase
- The students have actual hands-on labs and technology to use that they otherwise would not have
- More hands-on and more inquiry learning
- I include more hands-on activities because they are readily available

Briefly Describe How You Have Implemented the ASIM Biology/Chemistry Modules and Kits in Your Classroom

Themes

Biology

- I use many of the genetic modules in my Biology class when teaching that section of the course
- I use the ASIM modules to begin or introduce a new biological concept. Or I use the modules to reinforce concepts that I have taught. The modules provide input on students misconceptions
- I use the Biology modules to give students some hands-on experience with the material we study

Chemistry

- I use 1-2 kits a week in my Chemistry class. They are great for my Chemistry and my IB Chemistry class. I can use them as is or adapt them to be a little higher level needed
- I have integrated the ASIM modules into my Chemistry curriculum in such a way as to give students experience with a concept before teaching the concept itself

Appendix H

Recruitment Letter

AAHRPP DOCUMENT #193

UNIVERSITY OF ALABAMA
HUMAN RESEARCH PROTECTION PROGRAM

CONSENT FORM FOR NONMEDICAL INTERVIEW STUDY
UNIVERSITY OF ALABAMA

Individual's Consent to be in a Research Study

You are being asked to be in a research study. This study is called "Exploring Professional Development Experiences: Teachers' and Facilitators' Perceptions of Alabama Science in Motion". This study is being done by Linda Burruss. She is a doctoral student at the University of Alabama.

What is this study about?
The impact of professional development on student achievement in science education is continuously being questioned. Given that student learning is reflective of teaching practices in classrooms, it is imperative that we find ways to support teachers' with professional development. This study is seeking to investigate biology and chemistry teachers' and facilitators' perceptions of the ASIM professional development experience in regards to the impact, if any, it has on secondary classroom teachers instructional practices.

Why is this study important—What good will the results do?
The findings can assist in the restructuring in science education through hands-on learning. In addition, the findings can be used to determine the continuation of the training and what improvements can be made to generate better overall results. The results can be analyzed by administrators, central office staff in an effort to determine future use.

Why have I been asked to take part in this study?
You have been asked to participate in this study because you have participated in the ASIM professional development training in the areas of biology or chemistry as a teacher or facilitator. The main aspect of this portion of the study will focus on four teachers and two facilitators and their role in participating in the ASIM experience.

How many other people will be in this study?
The investigator hopes to interview two trainers of the ASIM, one biology trainer and one chemistry trainer and four biology and chemistry teachers.

What will I be asked to do in this study?

If you agree to be in this study, Linda Burruss will interview you in your office or a place of your own choosing about your experiences as an ASIM trainer. The interviewer would like to audiotape the interview to be sure that all your words are captured accurately. However, if you do not want to be taped, simply tell the interviewer, who will then take handwritten notes.

How much time will I spend being in this study?
The interview should last about 45-50 minutes, depending on how much information about your ASIM experiences you choose to share.

Will being in this study cost me anything?
The only cost to you from this study is your time.

Will I be compensated for being in this study?
In appreciation of your time, you will receive a $5 gift certificate to a local restaurant when the interview is completed.

What are the risks (problems or dangers) from being this study?
There are no risks, problems or dangers associated with being a participant in this study.

What are the benefits of being in this study?
There are no direct benefits to you unless you find it pleasant or helpful to describe your experiences with you ASIM professional development training. You may also feel good about knowing that you have helped your fellow educators with vital information on future professional development experiences.

How will my privacy be protected?
You are free to decide where I will visit you so I can talk without being overheard.
I will visit you in the privacy of your office or in another place that is convenient for you.

How will my confidentiality be protected?
The only place where your name appears in connection with this study is on this informed consent. The consent forms will be kept in a locked file drawer in Linda Burruss' office, which is locked when she is not there. I will not use a name- number list so there is no way to link a consent form to an interview. When I audiotape the interview, I will not use your name, so no one will know who you are on the tape. Once back in my office, I will type out the interview. When the interviews have been typed, the audiotapes will be destroyed. This should occur within one month of the interview. You may also refuse to be audio taped, in which case the interviewer will take handwritten notes.

What are the alternatives to being in this study?
The only alternative is not to participate.

What are my rights as a participant?
Being in this study is totally voluntary. It is your free choice. You may choose not to be in it at all. If you start the study, you can stop at any time. However, if you stop the interview, you will

not receive the gift card. Not participating or stopping participation will have no effect on your relationships with the University of Alabama.

The University of Alabama Institutional Review Board is a committee that looks out for the ethical treatment of people in research studies. They may review the study records if they wish. This is to be sure that people in research studies are being treated fairly and that the study is being carried out as planned.

Who do I call if I have questions or problems?
If you have questions about this study right now, please ask them. If you have questions later on, please call Linda Burruss at 256-851-8549. If you have questions or complaints about your rights as a research participant, call Ms. Tanta Myles, the Research Compliance Officer of the University at 205-348-8461.

You may also ask questions, make a suggestion, or file complaints and concerns through the IRB Outreach Website at http://osp.ua.edu/site/PRCO_Welcome.html. You may also e-mail us at participantoutreach@bama.ua.edu.

I have read this consent form. I have had a chance to ask questions.

Signature of Research Participant Date

Signature of Investigator Date

NOTES TO READER: This study would qualify for expedited review. The reading level (grade level) of the form is 8.4.

Dear Fellow Colleagues,

This email comes as a request seeking your assistance in participating in a focus group interview for a study I am conducting on professional development. The title of this study is "Exploring Professional Development Experiences: Teachers' and Facilitators' Perceptions of Alabama Science in Motion". I will ask eight questions for which you will respond. Your responses will be audio recorded and destroyed after being transcribed. In the event you are a willing participant, please respond to my request via email at slburruss@bellsouth.net.

If you have any questions and/or concerns, you may contact me at the email address above or via telephone.

Thanks,
Linda Burruss