EDITORIAL

Regina Panasuk

It has been 15 years since the Colloquium was launched, and with this issue the Journal completes its 15th year of publication. By all accounts, the Colloquium and the Journal have carved out a place for themselves in the Graduate School of Education. The major purpose of the Colloquium Journal is to create an opportunity for graduate students to share their research ideas, research in progress, or to present completed studies. Now, everyone at the GSE knows that there exists a safe and accessible space to publish and share ideas with others. Evidently, some of the GSE students make all efforts to write and submit their papers more than once during their formal course study before they complete their dissertations and even after successful defense. Some prefer to submit their most completed and significant research conducted in the course of the dissertation. I encourage all of you to test, enhance and expand your writing skills at the earlier stages of your degree program. It will help you in the development of your proposal and dissertation.

Nowadays, a serious attention is paid to the improvement of research in education. “Scientifically-based research” or scientific inquiry has been a major debate at the conferences and a favorite topic of the research journals. A committee of the National Research Council continuously examines the status and quality of research in education and produces reports that outline most critical features of scientifically reliable research and design principles to guide the creation of an advanced educational research enterprise. Scientific inquiry in education is one of the forms of viewing and describing reality. It is a way of knowing and understanding of ever changing educational system, which is a very complex social construct. It is a continual process of rigorous reasoning supported by strong association between methods, theories and findings, which influence curricula and policy. Schooling cannot be improved by relying on just folk wisdom about student learning and how schools can be organized. For that reason, there will be always a great demand in rigorous, sustained, scientific research to reengineer the schools in effective ways.

We belong to the community of educators who are constantly trying to learn, understand and improve educational processes. We make professional decisions that have both immediate and long-range effects on our students, teachers, parents and ultimately our communities. When conducting research we discuss theoretical and practical views of the real world, and ideology and ethics as they shape and form research in education. We equally value and apply a variety of sources of data, and carefully select the appropriate methods of inquiry. The better knowledge of making inquiries we have the better producers and consumers of educational research we are.

The major questions we always pose are to what degree our explanations of phenomena match the realities of the world and whether the research findings are valid and reliable. We make every effort for continuous verification our conjectures and conclusions, and look for new lines of inquiry that would provide more definitive answers to the questions we will address over time.

In the process of improving education, educational research when adequately supported, has benefited many dimensions of theory and practice. This is most apparent when discoveries, findings, and conclusions are widely disseminated through writing, analyzed and discussed. That is why I continuously encourage you to write and help me carrying on the Colloquium Journal publication.

In this issue I am pleased to present several articles that demonstrate our graduate students’ research endeavor.

Maria Nemerowicz investigated the reasons why some special education paraprofessionals who work in public school settings stay in their positions for years and why some leave after only a short time. Paraprofessionals today are being asked to perform responsibilities that were previously reserved for special education teachers. The steep influx of paraprofessionals and the high rates of attrition that accompany this trend schools are now facing with the challenge of retaining this rapidly expanding form of service delivery.

In her paper, Deborah McMakin focused on the needs for fostering educational equity through instructional practice. She suggested that one facet of culturally responsive teaching practice is conceptualizing cultural differences and recognizing how culture pervades education. She developed a case study to investigate how three middle class teachers conceptualized cultural differences and their implications for education over the course of a culminating field experience. This study examined how one participant’s understanding of cultural differences changed or maintained throughout a semester long field experience teaching experience in a school site with a culturally diverse student body.

Leslie Bolinger Horton asserts that the successful construction of mathematical knowledge is likely to depend upon the students’ ability to discover existing and meaningful relationships among concepts. She investigated the literature which suggested that incorporating a historical dimension into the mathematics classroom might help students to achieve a rich and deep construction of mathematical concepts. She found and analyzed the research studies, which indicate that although teachers accept the idea they are reluctant to put it into practice. In her paper she identifies those factors that affect teachers’ decisions regarding the inclusion of the history of mathematics in their curricula.

Shanna Rose Thompson examines whether continuation high schools, an alternative education program in California, provide supports and opportunities that build bonding and bridging social capital for at-risk youth. She provides a review of the growing body of literature on continuation high schools along with insights gained from an interview with Dr. Richard
GUIDELINES FOR SUBMISSION

The papers submitted for the Journal must discuss issues and trends related to educational research and practice.

WHEN SUBMITTING A PAPER, PLEASE USE THE FOLLOWING GUIDELINES:

1. Submit an electronic version of the paper, an abstract, approximately 150 words, and a biographical sketch, about 30 words. All pictures and diagrams must be submitted in a separate document.
2. Use double spacing with one-inch margins.
3. For references, tables, and figures follow the style described in the Publication Manual of the American Psychological Association (APA), Sixth Edition.
4. Paper must be submitted by December 1.
5. Authors will be notified about the status of their papers by January 15.
6. The Colloquium is scheduled in April.

A RESEARCH PAPER MUST INCLUDE:

a) a rationale and an identification of the research question(s),
b) a conceptual framework or brief statement of relationship to the literature,
c) an identification of research methodology,
d) a summary of the analytical technique(s),
e) a summary of preliminary findings.

The length of the paper length might be up to 30-40 pages, including pictures, tables, figures, and list of references.

A position paper for the Educational Resources section can be up to 20 pages. It must present new ideas and developments of major importance to practitioners working in the fields of mathematics and science education, language art and literacy, and leadership and schooling. It must reflect a variety of research concerns within the fields and deal with didactical, methodological and pedagogical issues.

SUBMIT PAPERS AND CORRESPONDENCE TO:

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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Title</th>
<th>Author(s)</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retention and Turnover of Special Education Paraprofessionals: A Multi-Site Case Study</td>
<td>Maria DeJohn Nemerowicz</td>
<td>1</td>
</tr>
<tr>
<td>Understanding Cultural Differences: A Pre-Service Teacher's View</td>
<td>Deborah McMakin</td>
<td>19</td>
</tr>
<tr>
<td>Teacher Perceptions on the Inclusion of History of Mathematics in the Classroom</td>
<td>Leslie Bolinger Horton</td>
<td>31</td>
</tr>
<tr>
<td>Investigating the Scientific Method</td>
<td>Sumudu Lewis</td>
<td>45</td>
</tr>
<tr>
<td>At-Risk Youth and Opportunities for Building Social Capital</td>
<td>Shanna Thompson</td>
<td>51</td>
</tr>
<tr>
<td>Qualifying Paper 2009</td>
<td>Biology Teachers’ Perceptions Regarding the Teaching of Evolution as a Concept</td>
<td>59</td>
</tr>
</tbody>
</table>

## Educational Resources

<table>
<thead>
<tr>
<th>Title</th>
<th>Author(s)</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investigating the Scientific Method</td>
<td>Sumudu Lewis</td>
<td>45</td>
</tr>
<tr>
<td>At-Risk Youth and Opportunities for Building Social Capital</td>
<td>Shanna Thompson</td>
<td>51</td>
</tr>
</tbody>
</table>

## Qualifying Paper 2009

<table>
<thead>
<tr>
<th>Title</th>
<th>Author(s)</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology Teachers’ Perceptions Regarding the Teaching of Evolution as a Concept</td>
<td>Richard Howarth</td>
<td>59</td>
</tr>
</tbody>
</table>

## CONTRIBUTORS

**Maria DeJohn Nemerowicz** completed her Ed.D. in 2009. She started her career as a paraprofessional. She is a Special Education Teacher for the Hudson Public Schools as well as an Adjunct Professor of Special Education at the Assumption College, MA.

**Deborah McMakin** teaches child development and research methods at the Framingham State College. She is a doctoral student in the Educational Leadership program and is currently working on her dissertation.

**Leslie Bolinger Horton** is a Professor of Mathematics at Quinsigamond Community College, and an Ed.D. candidate at the Math and Science Education program at UML. She is currently working on her dissertation proposal. Her areas of research interest include history of mathematics, learning styles, and non-Euclidean geometry.

**Shanna Thompson** is a student at the Leadership and Schooling Graduate Program. Prior to her doctoral studies, she served as a high school mathematics teacher in the cities of San Francisco and New Orleans. Her research interests include issues related to at-risk students.

**Sumudu Rupika Lewis** is a student at the Math and Science doctoral program. Prior to coming to the USA, she earned her Ph.D. in Chemistry and she was working as an Assistant Principal and STEM coordinator for schools in west London, UK.

**Richard Howarth** has been teaching Biology, Vertebrate Anatomy and AP Environmental Science at the North High School in Worcester, MA, and he is an adjunct faculty at the at the Becker College. He is currently working on his dissertation proposal in the Math and Science Education doctoral program.
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Annual Colloquium Journal vol. XV, Spring 2010

Retention and Turnover of Special Education Paraprofessionals
A Multi-Site Case Study

Maria DeJohn Nemerowicz
Hudson Public Schools, MA

ABSTRACT

The purpose of this study was to investigate and describe the reasons why some special education paraprofessionals who work in public school settings stay in their positions for years and why some leave after only a short time. This study investigated the reasons that lead to paraprofessional job retention and turnover in six Massachusetts elementary schools by using qualitative research methodology. Within the spectrum of qualitative research, this study used a multi-site, case study method.

Most paraprofessional stayers in this study were married, college educated, and over the age of 35 when they were first hired for the position. Additionally, more paraprofessionals who left were those who worked in ABA or one-to-one positions with students that had more intensive cognitive or behavioral needs. For many paraprofessional leavers, the position was a temporary job to fit their current lifestyle, but others left to pursue higher salaried positions because their financial needs had changed or their secondary household income was reduced or eliminated.

INTRODUCTION

Far from their early roles as clerical assistants and support aides for students in the primary grades, paraprofessionals today are being asked to perform responsibilities that were previously reserved for special education teachers. Over the past 40 years there has been a sharp rise in the numbers of paraprofessionals who support students in both general and special education settings (Ghere, 2003). In 1965 there were fewer than 10,000 paraprofessionals working in public schools, but today there are more than 500,000 (National Center for Educational Statistics, 2000). Despite these increases, studies have indicated that a vast number of paraprofessionals had less than two (Blalock, 1991) to four years (Elrod, Insko, & Williams, 1993) of experience. With the steep influx of paraprofessionals and the high rates of attrition that accompany this trend schools are now faced with the challenge of retaining this rapidly expanding form of service delivery.

The Individuals with Disabilities Education Act (IDEA) of 1997 defines paraprofessionals as persons who deliver instructional and direct services under the supervision of licensed professionals. Although their role was intended to be supportive in nature, the increasing reliance on paraprofessionals in schools has caused many to question special education service delivery (Giangreco, Smith, & Pinckney, 2006). Numerous studies indicate that paraprofessionals have been increasingly utilized as direct service providers and placed in roles where they are forced to make primary instructional decisions for the students they service (Giangreco & Broer, 2005). As a result of this shift in roles there has been a growing emphasis in the literature on the need for ongoing paraprofessional training and clearly defined roles and responsibilities (Downing, Ryndak, & Clark, 2000; French, 1999; Bugaj, 2002; Riggs & Mueller, 2001; Tillery, Werts, Roark, & Harris, 2003).

Since this shift in roles, there have been repeated calls for improving and increasing paraprofessional education, training, and support (French, 2003; French, 2001; Pickett, Likins & Wallace, 2003). Further, Blalock (1984) found that training paraprofessionals to meet these new demands is associated with increased levels of paraprofessional performance in the classroom. Although training and support lead to improvements in paraprofessional classroom performance, with the high rates of attrition within this group, investments in training alone do not appear to solve the problem. At the end of each school year, and even mid-year, paraprofessionals continue to leave their jobs. Training and knowledge acquired each year are lost because new employees require hours of initial and ongoing training and support to adequately fill these instructional roles (Ghere & York-Barr, 2007). The reason why these paraprofessionals leave and why a small number of paraprofessionals choose to stay in their position for years is still unclear.

RATIONALE FOR THE RESEARCH

Research has shown that under the direct supervision of a qualified teacher, and with ongoing training specific to their positions, paraprofessionals can effectively carry out follow-up instruction and other educational tasks (Giangreco & Broer, 2005). Many times however, paraprofessionals are used to provide the bulk of instruction and inclusion support to students with disabilities. Giangreco and Broer (2005) found that current special education delivery models are based on an over-reliance on under-trained paraprofessionals. They
note that these models are commonly used and they are not grounded in the current theories of research.

Ghere (2003) found that in response to the change in paraprofessional roles and responsibilities, special education teachers have become instructional leaders, managers, and staff developers, and they spend a great deal of time providing individualized training to paraprofessionals. Ghere (2003) also noted that directing the work of paraprofessionals is not a single event, but a multi-faceted job-embedded process that requires significant investments in time. Because paraprofessionals have assumed such vital roles with students and in programs, the cost of paraprofessional turnover is extensive for students, teachers, and school programs. New paraprofessionals must undergo this lengthy process of training but students with special needs continue to be serviced by these newly hired inexperienced service providers, regardless of where they are in their process of training. The special education teacher must spend more time with the newly hired paraprofessional than they would with more experienced individuals and as a result they have less time to focus on program-related duties (Ghere & York-Barr, 2007). Ghere (2003) summarizes her findings with a vivid metaphor: “Similar to a pebble dropped in a pond, the turnover of even one paraprofessional creates a ripple effect that spreads throughout an inclusive program. Repeated paraprofessional turnover creates repetitive ripples that simply drain energy from the organization” (p.211).

Ghere and York-Barr (2007) suggest that with the high rates of paraprofessional attrition there is an inherent loss of organizational knowledge. Prior training and previously acquired understandings about the job and organizational culture are lost each year. Developing a well-trained paraprofessional workforce becomes more complex than simply clarifying responsibilities and adding new professional development programs.

Given the size of the paraprofessional workforce and the vital instructional roles that they play in special education programs, the ramifications of turnover on students, programs, and school staff are significant (Ghere & York-Barr, 2007). Reducing this turnover minimizes the loss of time, energy, and professional development required to develop well-trained paraprofessional staff. Ghere and York-Barr (2007) note that given the high costs of paraprofessional turnover for school staff, fiscal resources, special education programs, and students, additional research in this area is needed. They call for further studies that will help schools better understand why paraprofessionals leave their positions and what decisions might lead to paraprofessional retention (Ghere & York-Barr, 2007).

Additional knowledge about why some paraprofessionals stay in their positions may help districts more effectively maintain a workforce of previously trained paraprofessionals. Further, it could help to minimize the negative impacts that paraprofessional attrition has been found to have on programs, school staff, and students (Ghere & York-Barr, 2007). Several studies have investigated the effects of paraprofessional attrition on special education teachers, students, and programs but there are few studies that have investigated the reasons for the high turnover rates or what conditions exist that influence a smaller number of paraprofessionals to stay in their position for years. Investigating the factors that encourage paraprofessionals to stay in the same district for years may contribute to the literature in both special education and employee turnover and retention.

RESEARCH QUESTIONS

The purpose of this study was to examine and understand the attributes that contribute to retention and turnover in special education programs. This research study had an overarching question that has guided this inquiry and it was supported by two questions that anchored the examination. These questions were as follows:

- What conditions exist that contribute to the retention and attrition of paraprofessionals?
- 1. What individual attributes contribute to the retention and attrition of paraprofessionals?
- 2. What institutional attributes contribute to the retention and attrition of paraprofessionals?

CONCEPTUAL FRAMEWORK

As a result of new legislation during the past several decades, an inclusion movement initiated by parents and advocacy groups, and special education teacher shortages, a reorganizing of programs and staffing patterns has occurred (Ghere, 2003; Nietupski, 1995). As paraprofessional numbers have increased, their responsibilities have shifted from clerical and supportive in nature to spending a great deal of their time making primary and often independent instructional decisions for students with special needs (Pickett et al., 2003; Giangregory, Edelman, Broer, and Doyle, 2001; Ghere & York-Barr, 2003; Wallace, 2003). The regulations outlined in the No Child Left Behind Act of 2002 (NCLB) mandated that schools receiving Title I funds must only hire paraprofessionals that have two years of post-secondary education, an associate’s degree, or a passing score on a state or local assessment. As a result of these
increased expectations, districts have responded with improved and increased professional development for their paraprofessional staff members.

Despite these efforts, paraprofessional burnout and high levels of turnover have still persisted. The two types of paraprofessionals found by Tillery et al. (2003) suggest that the majority of paraprofessionals leave within the first five years of employment, but that a smaller number of paraprofessionals stay at their jobs, thereby reducing the negative effects of turnover in some settings and districts. Unfortunately, not much is known about the differences between each group or how some districts have been able to maintain a larger group of paraprofessionals who stay in their schools for many years. With the noted changes in paraprofessional roles and responsibilities and requirements for training and highly qualified status, a closer look at the work experiences of paraprofessionals at different stages of this cycle is needed.

Although legislative changes and teacher shortages in special education provide an explanation for the shift in paraprofessional roles and responsibilities, it is not clear if or how this may be related to turnover and retention. Paraprofessional attrition is noted in the literature as an area of concern for schools and programs, but the causes for paraprofessional turnover remains largely uncharted territory (Ghere, 2003). Since the shift in roles, districts have been caught in a costly cyclical process of recruiting, hiring, training, and losing paraprofessional staff. The negative effects of this repetitive cycle are felt by students, parents, school personnel, and school programs. Not much is known about the experience of paraprofessionals as they enter and leave this revolving process. Even less is known about the small number of paraprofessionals who veer off from this dominant sequence as they settle into a school system. Perhaps if schools better understand the experience of paraprofessionals and the individual and institutional attributes that lead to retention, schools can break the costly cycle of turnover.

When paraprofessionals leave their positions there are system-wide ramifications. The loss of these paraprofessional resources have a significant impact on students, teachers, administrators, and special education programs (Ghere, 2003; Ghere & York-Barr, 2007). When a paraprofessional leaves their position a shift in responsibilities and additional time and resources must be spent on training, adjusting roles, and helping students adjust to the change. These losses were especially difficult for students when the paraprofessional left their position mid-year (Tillery et al., 2003; Ghere, 2003; Ghere & York-Barr, 2007). When paraprofessionals leave their position, teachers who relied on that support must now refocus their time and attention to retrain new paraprofessionals.

Changes in educational practices, evolving teacher roles, shifts in legislation and educational policy, and a shortage of qualified teachers all appear to be causes of the reversal of paraprofessional and special education teacher roles (Wallace, 2003; Ghere, 2003). Recent studies suggest that reorganization of staffing patterns has resulted from changes in how students with disabilities are serviced in schools, but it is not yet known if this is a contributing factor in the high rates of paraprofessional attrition. Although some researchers have suggested that paraprofessional attrition rates are related to low salary, a lack of career ladder opportunities, and a lack of respect and support (Ghere & York-Barr, 2007; Tillery et al., 2003; Giangreco et al., 2001), the exact reasons for the high levels of paraprofessional turnover are still not entirely clear. Additionally, it is not yet understood why some paraprofessionals choose to stay in their positions when such a high number chooses to leave after only a few years.

**Role Changes, Training and the Cyclical Nature of Turnover**

Special education service delivery has changed dramatically over the past few decades and new responsibilities have been placed on paraprofessionals. No more are paraprofessionals limited to carrying out clerical duties and minor supportive roles in the classroom. These newly formed roles and responsibilities have led to increased expectations for paraprofessionals in terms of instructional tasks and ongoing training. NCLB (2002) mandated that schools receiving Title 1 funds must only hire paraprofessionals that have two years of post-secondary education, an associate’s degree, or a passing score on a state or local assessment. As a result of these increased expectations, districts have responded with improved and increased paraprofessional professional development. Despite these efforts, paraprofessional burnout and high levels of turnover still persist. With their noted changes in paraprofessional roles and responsibilities, requirements for training and highly qualified status, and high levels of paraprofessional attrition rates, districts are caught in a costly cyclical process of recruiting, hiring, training, and losing paraprofessional staff. The effects of this repetitive cycle are felt by students, parents, school personnel, and school programs.

It has been documented in the literature that paraprofessional turnover is costly for districts, causes disruptions for students and programs, and increases the
workload of special educators (Ghere, 2003; Ghere & York-Barr, 2007). Despite the disruptions turnover causes, it remains one of the least studied areas within the realm of paraprofessional practices. Ghere (2003) argues that there is an immediate need to better understand the causes, impacts, and possible solutions to paraprofessional turnover. Schools may be more successful at retaining a quality paraprofessional workforce if more were understood about the effects that their changing roles, working conditions, and other unknown factors may have on current attrition rates. It is imperative that schools be aware of the individual and institutional attributes that contribute to paraprofessional retention. Understanding the individual attributes of paraprofessionals who stay for years and of those who work closely with them, may lead to more effective recruiting and more meaningful training and support for these important support staff members. Additionally, a broader understanding of the institutional factors that lead to paraprofessional retention can help policymakers and educators make more informed decisions so those factors can be replicated in our schools.

**METHODOLOGY**

This study investigated the reasons that lead to paraprofessional job retention by using qualitative research methodology. Within the spectrum of qualitative research, this study used a multi-site, case study method. Paraprofessional participants included individuals who have been employed as paraprofessionals for two years or less as well as those who were currently employed and who had been working in their position for over five years. Interviews with principals and district-level special education directors were incorporated into this study. The overarching goal of this investigation was to identify individual factors that increase the likelihood of retention.

**RESEARCH SITE AND PARTICIPANTS—SELECTION CRITERIA**

The three sites in this study were purposely chosen for the particular characteristics they share. By using a typical case-sampling model to select the sites and participants, this study aimed to illustrate and highlight what is characteristic in Massachusetts school districts with “typical” profiles so that findings can be generalized to similar settings. The research sites were purposefully selected with three objectives in mind. The first goal in selecting these particular sites was to find three districts that shared similar attributes such as programming practices and demographics. The research sites were selected because they had similar special education programs and service delivery models in their schools. All three districts maintained full and partial inclusion programs as well as services that were provided in substantially separate classroom settings. Additionally, more than 50% of students in each district received their special education services in a full inclusion setting.

The second objective in selecting these sites was to choose school districts that each maintained a heterogeneous paraprofessional population. In September of 2007, all three districts employed four or more paraprofessionals with two or less years experience as well as four or more paraprofessionals that have been there for over five years. They included paraprofessionals who worked in full and partial inclusion settings as well as those who worked in substantially separate classrooms as they supported students with special needs. Additionally, all three districts employed paraprofessionals at different stages in the highly qualified requirement process. These different paraprofessional populations have enabled the researcher to obtain specific data about retention and attrition from multiple perspectives.

The third objective was to choose sites that were of varying socioeconomic levels, but were still somewhat typical to the majority of remaining suburban districts in the state. Although the three districts were all located in the same county and on the urban fringe of a large city, the median household incomes for the three towns differed by $19,000 or more. Two of the three districts however shared similar rankings with other towns in the state. Each of these two towns had a median household income within $3000 of at least ten other towns in Massachusetts. In picking two typical districts the hope is that results can be generalized to districts that share similar profiles with the ones presented in this study. The third town was ranked in the top 10% of the state for median household income and was $46,000 higher than the middle-ranked district in this study. Although this district was primarily selected because it shared similar programs, special education student rates, and special education per pupil spending with the other two towns in the study, it also provided information about paraprofessional practices and institutional attributes that lead to retention and attrition in areas with higher socioeconomic levels.

**THE HOLMFIELD PUBLIC SCHOOL DISTRICT**

Holmfield is a suburban community that is located 28 miles from Boston. The town website notes that Holmfield is a quiet community of hard-working citizens which offers the beauty of a semi-rural New
England town as well as the convenience of a metropolitan suburb. Holmfield is situated near the crossroads of several major highways. It is also an economically well-developed community with a wide range of mature industry, including several leading technology-based corporations. The Holmfield Public School District serves a diverse cultural community and the schools offer a Portuguese bilingual program and a multi-cultural curriculum.

Holmfield is comprised of 2,900 students. Of these students, 590 are identified as having special needs. The rate of students in this district with special needs is 20%, which is the highest rate of the three districts in this study. Twenty-three percent of the students enrolled in special needs programs are from low-income households. Sixty-nine percent of the students with special needs receive their special education services while fully included in the regular classroom, 17% receive services in a partial inclusion setting, and 10% receive special education services in substantially separate settings within the public schools. The per-pupil spending for students in special education is $11,094 and the median household income is $72,000.

The two elementary schools in Holmfield that were chosen for this investigation are Fresco and Martin. Both schools have paraprofessionals who have two or less years and five or more years of experience working in the district. Fresco and Martin employ a total of 35 special education paraprofessionals to support students in full inclusion, partial inclusion, and substantially separate settings. At these two elementary schools 57% of the special education paraprofessionals are considered highly qualified.

The Crestfield Public School District

Crestfield is a suburban industrial town that is located 24 miles from a large city. In general, the northern parts of Crestfield tend to be more urban and densely populated, while the south is quite rural. The district website notes that educators utilize a learner-centered curriculum that stresses high expectations and standards for all learners.

The Crestfield Public School District is comprised of 5,600 students. Of these students, 790 are identified as having special needs. The rate of students in this district with special needs is 14%, which is the lowest rate of the three districts in this study. Nine percent of the students enrolled in special needs programs are from low-income households. Fifty-seven percent of the students with special needs receive their special education services while fully included in the regular classroom, 31% receive services in a partial inclusion setting, and 4% receive special education services in substantially separate settings within the public schools. The per-pupil spending for students in special education is $13,000 and the median household income is $91,000.

The Smithfield Public School District consists of one high school, two middle schools, and five elementary schools. The two elementary schools in Crestfield that were chosen for this investigation are Bart and Hartman. Both schools have paraprofessionals who have two or less years and five or more years of experience working in the district. Bart and Hartman employ a total of 30 special education paraprofessionals to support students in full inclusion, partial inclusion, and substantially separate settings. At these two elementary schools 57% of the special education paraprofessionals are considered highly qualified.

The Smithfield Public School District

Smithfield is situated midway between two large cities. It is a residential community with rural aspects and the median household income is $136,000. The Smithfield District is comprised of 3,300 students. Four-hundred and eighty of those students are identified as having special needs. The rate of students in this district with special needs is 15% and only 4% of the students enrolled in special needs programs are from low-income households. At both elementary schools all three models of service delivery are present, but vast majority of students in special education are serviced in the full inclusion to partial inclusion model. Seventy-two percent of the students with special needs receive their special education services while fully included in the regular classroom, 20% receive services in a partial inclusion setting, and 4% receive special education services in substantially separate settings within the public schools. The per-pupil spending for students in special education is $12,000.

The Smithfield Public School District consists of four elementary schools, one middle school and a regional high school located in the district. The two elementary schools in Smithville have paraprofessionals who have two or less years and five or more years of experience working in the district. Lincoln and James employ a total of 21 special education paraprofessionals to support students in full inclusion, partial inclusion and substantially separate settings. At these two elementary schools 90% of the special education paraprofessionals are considered highly qualified.

Each of the participating sites in this study has a district-wide special education parent group. In addition to
these organizations at the district level, each school has a general parent group. Table 1 outlines district and school attributes for each participating site.

The data collection methods that were utilized in this study were interviews, focus groups, and document analysis. Gathering information from diverse sources provided the researcher with greater insight about paraprofessional turnover and retention. Individual interviews were conducted with the special education director in each district and the principal of each of the six schools. In each of the six schools there were two paraprofessional focus groups. The stayers group at each school consisted of two to three special education paraprofessionals who had been employed in their district for over five years. The newbies group at each school consisted of two to three special education paraprofessionals who had been employed in their district for two years or less. Paraprofessionals who had left their positions were referred to as the leavers. Although the leavers were not actual participants in this study, discussions about the perceived reasons for their leaving were part of the interview and focus group discussions.

In this study, paraprofessional contracts and initial data surveys on paraprofessional turnover rates for each school were analyzed. In addition to turnover data and contracts, communiqués sent to paraprofessionals as a group from the principal, pupil services director, and special education teacher were used to provide a more thorough analysis of practices and retention strategies used in each district. Communications distributed about paraprofessionals were also examined. Data about school-specific paraprofessional turnover rates were also collected. The initial questions asked for paraprofessional attrition data from the 2004–2007 school years. Three consecutive years of data collected on schools in each district allowed the researcher to make data-based comparisons among individual schools and districts.

**ANALYTICAL TECHNIQUES**

NVivo 7 Software is a tool that helped this researcher plan for and analyze the data collected from interviews and focus group sessions. NVivo serves as an electronic repository for qualitative data that is collected. Manipulation and analysis of qualitative data can take place in steps and can be imported into this electronic storage container as it is collected. Step one began with the development of an NVivo shell. The data collection methods that were utilized in this study were interviews, focus groups, and document analysis. Each interview and focus group transcription was entered into the NVivo shell as a document and named by type, school, and district (i.e. Stayers Bart Holmfield). Each document was then placed into a folder by participant type (Newbies, Stayers, Principals, or Sped Directors). Then cases were created for each district, school, paraprofessional group, and individual participant.

Step two began with the coding of interview and focus group transcriptions. The three common ways that data is organized in qualitative research is through descriptive coding, topic coding, and analytical coding. All three of these were used in this investigation and each had a unique purpose. Richards (2005) maintains that descriptive coding is much like quantitative coding because it involves storing information about the cases that are being studied. This type of coding was done by appropriating values to each variable in each case and storing the data in NVivo. This method of coding assisted the researcher in storing and quickly retrieving routine information about the cases (such as the years of work experience).

Topic coding is a type of qualitative coding that enables a researcher to label text according to its subject. This researcher used topic coding so that the specific topics that were coded could be retrieved and examined during the analytic process. It also helped to identify patterns that emerged. Analytical coding is described as being central to qualitative investigations

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Attributes of Each District</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Students</td>
</tr>
<tr>
<td>Holmfield District</td>
<td>2,900</td>
</tr>
<tr>
<td>Crestfield District</td>
<td>5,600</td>
</tr>
<tr>
<td>Smithville District</td>
<td>3,300</td>
</tr>
</tbody>
</table>
because it leads to the emergence and the affirmation of theories (Richards, 2005). These types of codes are often stored as attributes within a researcher-created category. Richards (2005) asserts that it requires the researcher to interpret a passage, reflect on its meaning, and create a category for that idea. Analytical coding enabled this researcher to develop assumptions and categories that emerged from the data. The researcher made attempts to substantiate these emerging theories through voluntary email correspondences of actual coding reports with the research participants.

VALIDITY

Maxwell (2005) asserts that internal generalizability (the generalizability of a conclusion within the setting or group studied) is crucial to qualitative research, while external generalizability (refers to its generalizability beyond that setting or group) is not. He notes that that descriptive, interpretive, and theoretical validity of a case study all depend on their internal generalizability. Although external generalizability may not directly result from this investigation, the aim was to demonstrate validity in the descriptions of each case based on the data that was collected from the multiple interviews, focus group sessions, and data on paraprofessional turnover rates, and document analysis. Creswell (2003) contends that there are eight strategies available that can help increase accuracy of the findings. She recommends identifying one or more of these strategies in a research proposal. Four of the eight were applied in this research study.

First, the validity of this study was sustained by triangulating the data sources. In this study the researcher used a combination of interviews, focus groups, paraprofessional turnover data, and document analysis. Through interviews and focus group sessions in six schools within three districts, special education directors, principals, and paraprofessionals have provided multiple perspectives of paraprofessional attrition and retention. Analysis of the paraprofessional contracts, communications, and job descriptions revealed further information about job expectations, benefits, and working conditions. Attrition data provided definitive information about the actual turnover rates for each school and how they have changed over time. This data provided a quantitative measure to more thoroughly describe turnover and retention at each school.

Member-checking is another procedure that Creswell (2003) recommends for increasing the likelihood that the research findings will be valid. In this study, each participant was emailed the full transcription of the interview in addition to an Nvivo coding report. Each report was a rich text file of coding results that was specific to each interview and focus group. Participants had the opportunity to review all researcher-coded text from the interview and they were encouraged to identify any errors, omissions, or misinterpretations.

The final methods were intertwined and they included clarifying bias and debriefing with peers. This researcher engaged in ongoing clarification in the form of memos and peer debriefing with fellow doctoral candidates in the Leadership in Schooling program at UMASS Lowell. During the coding process areas of potential researcher bias were identified in debriefing sessions and later coded by the researcher. These areas were then highlighted in the transcriptions so that they were evident to the participants (for member-checking), the researcher’s colleagues (for further peer debriefing), and to the researcher (for memo-writing/reflection and analysis). Areas that were coded for possible bias include areas that were both researcher-indicated and peer-indicated during debriefing sessions. In corresponding emails, study participants were made aware of the highlighted text and asked to pay particular attention to coding in these areas due to possible researcher bias.

FINDINGS

A cross-case merged findings methodology (Stake, 2006) was used to analyze and describe turnover and retention in the six participating schools. Through analysis of the coded responses of the individual cases, themes emerged among the cases. Most of the themes were common in individual cases and across cases, but a few others were not evident in the individual cases until a merged findings analysis of all cases was created.

Paraprofessional Employment Data and Turnover Rates

In the 2007–2008 school year, Smithfield had 51% of paraprofessionals who were employed for over five years and 21% employed for less than two years. Smithfield had a three-year turnover rate of 21.5%. As the largest of the three districts in this study, Crestfield employed the most paraprofessionals and had retained 48% of those employees for over five years. At 7% they have the lowest three-year turnover rate in this study. Surprisingly, they had two years with no turnover at Hartman Elementary School. Holmfield had the lowest number of stayers at 30% and the highest number of newbies at 43%. At 27% Holmfield has the highest level of turnover of all three districts in the study with close to a 50% turnover in the 2006-2007 school year.
Analyses of programs and participant data reveal some notable trends in relation to turnover and retention. Tables 2 and 3 illustrate the district comparison of paraprofessional employment and turnover data.

### Table 2

**District Comparison of Paraprofessional Employment Data**

<table>
<thead>
<tr>
<th>District-Wide Paraprofessional Turnover Rates and Highly Qualified Status</th>
<th>Number Employed 2007–2008</th>
<th>Percent Employed Over Five Years</th>
<th>Percent Employed for Less Than Five Years</th>
<th>Percent Employed for Less Than Two Years</th>
<th>Percent Who Are Highly Qualified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holmfield District</td>
<td>80</td>
<td>30%</td>
<td>70%</td>
<td>43%</td>
<td>86%</td>
</tr>
<tr>
<td>Crestfield District</td>
<td>106</td>
<td>48%</td>
<td>52%</td>
<td>27%</td>
<td>84%</td>
</tr>
<tr>
<td>Smithfield District</td>
<td>47</td>
<td>51%</td>
<td>49%</td>
<td>21%</td>
<td>95%</td>
</tr>
</tbody>
</table>

For James and Lincoln only

### Table 3

**District Comparison of 3-Year Paraprofessional Turnover Rates**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Holmfield District 3-Year Turnover Rate: 27%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fresco Elementary</td>
<td>20% Turnover 10% - unknown 10% - maternity leave</td>
<td>20% Turnover 20% - unknown</td>
<td>30% Turnover 30% - unknown</td>
</tr>
<tr>
<td>Martin Elementary</td>
<td>47% Turnover 41% - unknown 6% - teaching job</td>
<td>25% Turnover 19% - unknown 6% - teaching job</td>
<td>21% Turnover 21% - unknown</td>
</tr>
<tr>
<td>Holmfield School District</td>
<td>33% Turnover</td>
<td>23% Turnover</td>
<td>25% Turnover</td>
</tr>
<tr>
<td>Crestfield District 3-Year Turnover Rate: 7.3%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bart Elementary</td>
<td>13% Turnover 13% - relocated</td>
<td>14% Turnover 14% - relocated</td>
<td>9% Turnover 9% - not asked back</td>
</tr>
<tr>
<td>Hartman Elementary</td>
<td>15% Turnover 5% - relocated 5% - teaching job 5% - took a job out of education – needed to make more money</td>
<td>0% Turnover</td>
<td>0% Turnover</td>
</tr>
<tr>
<td>Crestfield School District</td>
<td>14% Turnover</td>
<td>4% Turnover</td>
<td>4% Turnover</td>
</tr>
<tr>
<td>Smithfield District 3-Year Turnover Rate: 21.5%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lincoln Elementary</td>
<td>11% Turnover 11% - different in-district non-para job</td>
<td>30% Turnover 30% - unknown</td>
<td>8.3% Turnover 8.3% - teaching job - other community</td>
</tr>
<tr>
<td>James Elementary</td>
<td>25% Turnover 8.3% - not asked back 8.3% - relocated 10% - unknown</td>
<td>27% Turnover 18% - unknown 9% - maternity leave</td>
<td>30% Turnover 10% - unknown 10% - teaching job - other community 10% - relocated</td>
</tr>
<tr>
<td>Smithfield School District</td>
<td>18% Turnover</td>
<td>28.5% Turnover</td>
<td>18% Turnover</td>
</tr>
</tbody>
</table>

Note: Annual turnover data calculated for each district: paraprofessional leavers for both schools divided by the total number of paraprofessionals that were employed in both schools in September of that year. 3-Year turnover data calculated for each district: Average of district percentages for three years.
Paraprofessional demographic data were collected in the form of a written questionnaire.

In addition to completing background information questionnaires, participants were asked why they chose to stay throughout the years. They also discussed leaver paraprofessionals that they had known and the reasons why they had left the position. In addition to paraprofessional responses, administrative surveys were collected for each school and district relating to the reasons for turnover in the past three school years for each staff member who had not returned.

Throughout the sources, four main individual attributes were identified in the stayer paraprofessionals. Of these four attributes the first three were also ranked among the top three attributes coded in each individual case. Of the 20 stayers, 90% of them were age 35 or older when they were first employed as paraprofessionals in the district. Additionally, there were no stayer paraprofessionals under the age of 40 throughout all of the district paraprofessional participants, but 35% of the newbie paraprofessionals were younger than 40. Participants from all six stayer focus groups across the districts also made references that indicated some common individual attributes among the stayers. It is important to note that the references were not exclusively noted among stayers, but only the responses of the stayer paraprofessionals were noted in an effort to understand why individuals have remained in the position. It is possible that some newbie participants may eventually become stayers, but for the purpose of understanding the stayers, only their responses were examined for this question. Table 4 reveals the data collected from paraprofessional questionnaires and focus group sessions with the stayer paraprofessionals.

When asked about the reasons that encourage them to stay, paraprofessional participants in all six focus groups made 12 references about their personal enjoyment in working with students. Paraprofessionals throughout the stayer groups also made references about their desire to have a work schedule that was aligned with school hours and their desire to learn new things. Many of these individual attributes were embedded within one response. Here a Martin stayer from Holmfield explained how the position fits her lifestyle.

I like coming to work, I like working with the kids, I like working with my other peers in the building, I enjoy that, I think that is what keeps me here. I enjoy learning what I am doing because I didn't know this job before that and I would like to continue it so I like doing this, that is why I come here everyday, umm, I just like doing what I am doing, that is why I like being here.

Paraprofessionals noted that their personal enjoyment of working with students and witnessing student progress as a result of the support that they had provided was something that had encouraged them to stay in the position for years.

Paraprofessional stayers in five of the six focus groups also made 11 references about their need to have a work schedule that is aligned with school hours. Forty percent of these paraprofessionals noted that they had children in the district. Many of these participants stated that supervisors were understanding and accepting when paraprofessionals needed to leave to care for sick children. Paraprofessionals in several groups also noted that they remained in these positions because of the opportunities to learn new things each day. Paraprofessionals maintained that they are encouraged to stay because of their desire to increase their knowledge base of curricular content and/or special education pedagogy.

**INDIVIDUAL ATTRIBUTES THAT CONTRIBUTE TO ATTRITION**

When participants were asked about the reasons why paraprofessionals had left the district the most common response was that leavers had chosen employment as a paraprofessional as a temporary job and not a long-term career choice. Other reasons discussed in at least half of the participant sources were the need for a higher salary and education majors who left to pursue a teaching position. Table 5 [next page] reveals the data.
collected from paraprofessional questionnaires, participant focus groups, and administrative surveys relating to individual attributes that contribute to retention.

Of the 21 paraprofessional and administrative sources, 13 sources made 17 references about paraprofessionals who chose to leave the position so that they could pursue another career. Sources throughout all three districts noted that the choice to become employed as a paraprofessional was often a convenient but temporary decision for many individuals as they took steps to pursue their true career. Other participants discussed that paraprofessionals often return to previous professionals after working as a paraprofessional for a period of time. Some paraprofessionals even noted that they would not likely be returning the following school year.

Paraprofessional participants in three of the six newbie focus groups noted that their employment in this position was only temporary as they had plans to further their education or gain employment in another field. The next most common individual attribute that contributed to attrition was the need for a higher salary. Of the 21 sources, 12 sources made 20 references about people who had left the position because of their need to make a higher salary. Throughout eight sources in all three districts participants noted that paraprofessionals that they had known left or were likely to leave due to changes in personal financial circumstances. It is important to note that of the three districts, the attrition due to the need for a higher salary was only discussed by one source (Lincoln Stayer Focus Group) in the district of Smithfield. Interestingly, Smithfield participants were the only individuals to respond that salary was not a major factor of why paraprofessionals leave. They made four references to paraprofessionals having stable household incomes and the financial freedom to remain in a lower paying position. The remaining 11 sources that noted attrition due to the need for a higher salary were more equally distributed between the other two districts with six of the sources originating in Crestfield and five from Holmfield.

Like the first attribute, the third most common reason that participants noted for turnover occurred more uniformly throughout the three districts. Participants in 11 sources made 13 references about paraprofessionals who left because they were pursuing a degree in education or employment as a teacher. Some participants referenced that paraprofessionals left to pursue a teaching position, complete their student teaching requirements, or finish working on their degrees or certifications. Throughout these sources participants discussed that although some paraprofessionals left to pursue their teaching degrees and gain employment outside the district, a number of them went on to become teachers in-district.

**THE IMPACT OF INDIVIDUAL SOCIOECONOMICS ON TURNOVER AND RETENTION**

Insufficient salary was referenced as one of the top institutional attributes that lead to turnover in the three study districts. Although salary is determined by each district, individual socioeconomic factors influenced whether paraprofessionals were able to stay in the position for years. Of the stayer paraprofessionals 95% were married and 5% were divorced and in four sources paraprofessionals noted that they had a secure second household income. Five of the nine administrators also noted that stayer paraprofessionals tended to be married and rely primarily on spousal income. The Lincoln principal described the stayers at her school:

> I think most of my paraprofessionals are married, stable, good income coming in from other sources and they want to do something meaningful. They want to be in touch with a challenge and some of them are working for the benefits. I think a couple of them have self-employed husbands who make nice livings but need the health insurance or whatever. So, yes, I think socioeconomics really plays in here. This is a comfortable population.

Several of the paraprofessionals in the four stayer sources explained that their continued employment as
Paraprofessionals was dependent on their husband's income. Even stayer participants whose husbands were struggling to find jobs or being laid off talked about the possibly of leaving their position so they could make more money. A Lincoln stayer from Smithfield explained, “If my husband lands on his feet, I am a big fan of inertia, I don't want to go anywhere or do anything but if he doesn't, then I need to step up.” Paraprofessionals throughout four groups stated that they were not doing this for the money, but they also maintained that they could not do the job without having some level of financial security. If that security was in jeopardy, even seasoned paraprofessionals were at risk for leaving the position.

In addition to secure household incomes some patterns emerged in the stayer group demographics. Of the 20 paraprofessional stayer participants 75% had college degrees and 25% had taken some college courses. Additionally, all of the stayers were between the ages of 40-59 with 80% between the ages of 50-59. Finally, 75% of the stayers lived in the district and 40% had children who attended school there. Although some similar patterns emerged with newbie paraprofessionals, some of these newbies could be potential stayers and demographic data was not collected about leaver paraprofessionals.

**Institutional Attributes that Contribute to Retention**

Paraprofessional participants in the study were asked about the aspects of the position that had encouraged them to stay. Table 6 reveals the top four cross-district institutional attributes that contribute to paraprofessional retention.

In all six stayer focus groups paraprofessionals made 15 references about the high levels of collaboration and the positive relationships between co-workers at their schools. Many paraprofessionals discussed that they enjoy the high level of collaboration between employees and this has encouraged them to stay throughout the years. Collaboration was defined by high levels of communication about students and learning between staff members. Paraprofessionals noted that they are encouraged to stay because even though they deal with difficult behaviors and challenging situations, they feel that they always have somewhere to go for assistance.

Another reason paraprofessionals gave for staying in their positions was that they had established positive and close relationships with fellow co-workers. Stayers noted that each year they are asked for their preference in where they would like to be placed for the following year and that their placement opinions had most often been honored. Participants noted that they have developed strong friendships with fellow staff members and continued employment with these individuals had encouraged them to stay throughout years. They also discussed that they relied on each other and could communicate with each other when aspects of the job became frustrating. Lincoln stayer from Smithfield explained these relationships:

Well, the assistants get along real good. We go out to dinner and vent every other month, and the majority of us are older women, you know, we have all had other careers, have come back to this, and you know, are really in it for the long term and certainly not the money.

In all six stayer focus groups paraprofessionals made seven references about the strong sense of community at their schools. Stayer participants noted that a school attribute that encouraged them to stay each year was this sense of community. Community was defined by stayers across the districts as an environment where parents, teachers, paraprofessionals, and students were caring and highly involved in both the academic and social learning process.

Some paraprofessionals noted the intimacy of working in a smaller school where they developed long-term friendships.

Paraprofessional stayers in five of the six sources also made nine references about the flexibility of the position. Paraprofessionals noted that they were motivated to remain in the position because of the convenience of the

<table>
<thead>
<tr>
<th>What institutional attributes contribute to the retention of paraprofessionals?</th>
<th>Total (6 Sources)</th>
<th>Holmfled Stayer Paras (2 Sources)</th>
<th>SPED Stayer Paras (2 Sources)</th>
<th>Principals Stayer Paras (2 Sources)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment with High Levels of Collaboration - Positive co-worker Relationships</td>
<td>6/15</td>
<td>2/5</td>
<td>2/7</td>
<td>2/3</td>
</tr>
<tr>
<td>Sense of School Community</td>
<td>6/7</td>
<td>2/2</td>
<td>2/2</td>
<td>2/3</td>
</tr>
<tr>
<td>Convenient Work Schedule</td>
<td>5/9</td>
<td>2/3</td>
<td>1/2</td>
<td>2/4</td>
</tr>
<tr>
<td>Environment where Employees Feel Respected and Valued</td>
<td>5/7</td>
<td>2/3</td>
<td>1/1</td>
<td>2/3</td>
</tr>
</tbody>
</table>
work schedule and work year. Many of the paraprofessionals noted the convenience of this position and that they stayed because the flexibility of this position allows them to deal with other things that were important in their lives.

Throughout five of the six stayer groups, participants made seven references that they were encouraged to stay because of the level of respect and value that they received from staff. Paraprofessionals maintained that colleagues respected their work and treated them as equals. Paraprofessional participants also noted that they were encouraged to stay because their contributions were solicited and valued by fellow co-workers.

Although the first two attributes (collaboration and sense of community) also emerged as the top individual district attributes that had encouraged stayer paraprofessionals to remain in their positions, the third and fourth most-commonly cross-referenced attributes were only rated in the same sequence in Holmfield and Smithfield. There was not a third or fourth rated institutional attribute that contributed to retention in Crestfield.

**Institutional Attributes that Contribute to Attrition**

When participants were asked about the institutional attributes that have contributed to paraprofessional attrition the most common response was job-related burnout due to the assignment of students in an Applied Behavior Analysis (ABA) or a one-to-one personal aide position. Other reasons discussed were insufficient salary, the inability to advance in their career, and unexpected job responsibilities. The themes were presented in this cross-case section but the first two attributes listed in Table 7 also emerged as the top individual district attributes that had contributed to attrition. Table 7 reveals the data collected from paraprofessional questionnaires, participant focus groups, and administrative surveys relating to institutional attributes that contribute to paraprofessional attrition.

Of the 21 paraprofessional and administrative sources, thirteen sources made 16 references about paraprofessionals they had known who had left the position because they experienced job-related burnout from either a one-to-one assignment with a student who had challenging behaviors or severe special needs. It was also reported throughout these sources that burnout and turnover occurred more frequently in paraprofessionals who worked in the ABA programs. The ABA paraprofessionals in the three participating districts were assigned to work with students diagnosed with autism spectrum disorders. ABA paraprofessionals are sometimes referred to as ABA therapists or ABA tutors and they are specially trained to work in these positions. The special education director from Holmfield explained the higher turnover rates for ABA and one-to-one paraprofessionals:

> I think you either see them here for a couple of years or they stay. We get a lot of turnovers in the ABAs. Like I said, I think the turnover rate depends on the severity of the children they are working with. I think the children that are the most needy, especially the ones that are the most behaviorally challenged, I think that is where you see more of the turnover rates possibly from the burnout factor, which a lot of teachers get as well too. I think the inclusion aides are the ones that I tend to see stay. We might shift them from school to school but they are here long term. Generally when we are looking for a position to fill, it is going to be a one-to-one or an ABA. That is the trend that I have seen over the last two years.

In addition to ABA assistants, some paraprofessionals are assigned as one-to-one personal aides. One-to-one personal aides were defined as those who worked with the same student all of the time. High turnover with this group was noted throughout several sources. Throughout the sources participants noted that many paraprofessionals leave after having been assigned to work one-to-one with a student with significant needs or behavioral challenges. They asserted that although these individuals might have enjoyed working with students, the challenges and frustrations of working with the same student with such intensive needs all day would often lead to burnout and eventually, cause them to leave. The Martin principal of Holmfield explained...
that the job of a one-to-one paraprofessional was not only challenging, but the most difficult position to fill. She noted that they had already lost three one-to-one paraprofessionals during the present school year.

In nine of the 21 sources, ten references were made about paraprofessionals leaving the position due to the low salary. Most participants noted that paraprofessionals left because the salary did not match the level of work that was required of them. Even stayer participants were noting that they would have to be leaving the position if the salary did not increase more significantly in the next contract. Some paraprofessionals noted that they would be leaving at the end of the school year. A Fresno stayer from Holmfield maintained that she was going to have to leave the job that she had been at for years and truly enjoyed because of the insufficient salary.

In seven of the 21 sources eight references were made about paraprofessionals leaving the position because of the lack of career ladders. They noted that this was not the position for someone who was looking to advance in their career. One Martin newbie from Holmfield noted that she would be leaving the position at the end of the year. Participants throughout these sources noted that the only chance to advance was to become a teacher and that had caused many paraprofessionals that they knew to leave. Some paraprofessionals noted also that this lack of career ladders was likely to be discouraging to paraprofessionals.

Some paraprofessionals had suggestions in lieu of career ladders. They noted that if paraprofessionals had opportunities to advance and make some money for being leaders or mentors to other paraprofessionals, such opportunities might encourage them to stay longer. A Martin stayer from Holmfield elaborated:

I agree with her, it is frustrating. I wish they would put together at least a mentor-type program, you know at least that would give us the opportunity to help new people coming in and the teachers have a mentor program, they get a little stipend, it would give us the ability to help, maybe work with those kids and keep more people, get more people to stay.

In five of the 21 sources, participants made five references about paraprofessionals leaving because of unclear expectations about the job. It is important to note that these references were only made in Holmfield and Crestfield. Participants suggested that paraprofessionals often started a job with a simplistic idea about their responsibilities, but would leave early on because they were not clear about the more specific responsibilities required of their individual positions. Participants in these sources noted that job descriptions needed to be more specific so that paraprofessionals for individual positions knew what would be expected of them before they were offered the position.

**OBSERVATIONS, IMPLICATIONS, AND RECOMMENDATIONS**

The study aimed to explore the conditions that exist that contribute to the retention and attrition of paraprofessionals. As each observation is presented particular attention is given to the implications for future educational reform measures that aim to improve paraprofessional retention. Findings from the individual and cross-case analysis have supported a number of hypotheses about paraprofessional turnover and retention as they exist within and among the three districts in this study. Each of these observations is discussed with particular attention given to implications and suggestions for educational reform. The observations are:

- **Observation #1** - Most paraprofessional stayers were married, college educated, over 35 when first hired, with a stable second household income and a strong desire to learn and be a part of student progress. Although this population has been relatively stable for years, several paraprofessional stayers noted that they would have to seek out other positions due to current financial difficulties.

- **Observation #2** - More leavers were reported about paraprofessionals who worked in ABA or one-to-one positions with students that had more intensive cognitive or behavioral needs, and paraprofessional participants who were currently in these roles noted that they did not have enough contact with or support from special education teachers.

- **Atypical Observation** - For many paraprofessional leavers, the position was a temporary job to fit their current lifestyle, but others left to pursue higher salaried positions because their financial needs had changed or their secondary household income was reduced or eliminated.

**THE STABLE STAYER PARAPROFESSIONAL**

Most paraprofessional stayers in this study were married, college educated, and over the age of 35 when they were first hired for the position. The questionnaires and responses of the 20 paraprofessional stayer participants revealed that 95% were married, 85% had some type of college degree, and 90% were age 35 or...
older when they were first employed as paraprofessionals in the district. The traits that were commonly noted by stayer paraprofessionals were a strong desire to learn, the enjoyment of being a part of student progress, and the convenience of having a schedule that is aligned with school hours. Paraprofessionals from all three districts noted that they had chosen to stay in this position because these factors were most important to them.

Many of the paraprofessional stayers in this study noted that they took on some of the most challenging positions and that for years they had carried out lesson planning, the initial teaching of concepts, and the creation of modifications for the students that they serviced. Stayer paraprofessionals throughout the three districts also noted that they had a strong desire to learn new things, but they talked at length about their discontent with much of the district-run professional development. Seasoned paraprofessionals noted that professional development was often redundant because they had either attended similar training in past years or learned the information in their years of teaching and supporting students. They maintained that professional development was most helpful when they were allowed to attend the workshops that were relevant to their current teaching situations. To help feed this desire to learn, districts should provide paraprofessionals with relevant professional development opportunities. Differentiating training opportunities on district-sponsored professional development days can allow novice paraprofessionals to obtain the skills they need as new service providers but it would also allow experienced paraprofessionals to participate in more applicable trainings. When possible, they should be encouraged to attend the workshops that are most meaningful and purposeful to their unique situations.

Paraprofessionals also maintained that much of their learning occurred on the job, but that they had limited time with their supervising teacher. Due to this limited time for interaction and training they often were unsure if the services that they were providing were the most appropriate or effective. With this in mind, districts should be attentive of this need for teachers to have time to work with and train paraprofessionals. In addition to time, teacher education programs should be designing courses for special educators and other supervising teachers to prepare them for the task of supporting and training paraprofessionals. Educators should be taught how to supervise and work with paraprofessionals and how to provide them with appropriate on-the-job training.

Through creative scheduling, paraprofessional mentoring and training can occur during the school day with little or no financial outlay. The cross-case findings suggest that paraprofessionals are encouraged to stay in their position when they have opportunities to develop positive co-worker relationships. They noted that they had a desire to be mentored by fellow paraprofessionals and to collaborate about students on their caseloads. By encouraging experienced paraprofessionals to become peer coaches or mentors to newer paraprofessionals, districts can take steps to provide more relevant support to new staff, while acknowledging the value and expertise of the more seasoned paraprofessionals. Staff members that are chosen for these leadership roles within their schools could be compensated with a small stipend or extra personal days for the support and guidance they provided throughout the school year. By taking this first step to acknowledge valuable stayer paraprofessionals, districts would provide paraprofessional staff with meaningful opportunities for collaboration while developing a stronger sense of community within each school.

Another common finding that emerged was that many stayers were able to continue in this position because they had a stable secondary household income. Throughout both questionnaires and focus group discussions 14 of the 20 stayer paraprofessionals noted that if this secondary income were to decrease or be eliminated, they would not be able to remain in this position as they would be forced to seek out a higher paying job. Paraprofessional stayers in all three districts had discussions about their desire to stay in the position and their discontent about possibly having to leave if their financial circumstances change.

In the United States, the past three decades have been a period of relative economic stability and growth. This period of stability has made it much easier for paraprofessionals to stay in positions that may not have been as financially rewarding as they were intrinsically rewarding. Recently, the United States, along with many other countries has found itself facing significant economic downturn. Many economists speculate recession looms for the U.S. economy. Paraprofessionals in this study have noted time and again their uneasiness about these economic times and several have noted that even they may become leavers and pursue careers in their degree areas. The valuable steadfast stayers may in fact become leavers themselves, as the current economic crisis worsens and financial instability grows at home.

School districts are now going to be faced with difficult choices regarding paraprofessional expenditures. It has been documented in the literature that paraprofessional turnover is costly for districts (Ghere, 2003; Ghere & York-Barr, 2007). Ghere and York-Barr (2007) assert that districts are burdened by the high levels of
paraprofessional turnover because they must use local district funds to recruit, interview, and train new employees. Kaye and Jordan-Evans (2001) note the cost of replacing an employee varies between 70% and 200% of their annual salary. With the current financial situation, districts are now going to be forced to make some tough decisions about staffing, compensation, and the funding of programs. It may seem counterintuitive in raising the salaries of paraprofessionals during a period of economic instability, but this move might actually provide savings for districts in the long run. By addressing one of the major reasons that paraprofessionals give for turnover, districts can take steps to retain their most valuable and experienced paraprofessionals.

Higher Turnover with ABA and One-To-One Positions

Throughout the data sources in this study, more leavers were reported about paraprofessionals who worked in ABA or one-to-one personal aide positions with students that had more intensive cognitive or behavioral needs. Of the 21 paraprofessional and administrative sources, 13 sources made 16 references about paraprofessionals they had known who had left the position because they experienced job-related burnout from either a one-to-one assignment with a student who had challenging behaviors or severe special needs. It was also reported throughout these sources that burnout and turnover occurred more frequently in paraprofessionals who worked in the ABA programs. Interestingly, the paraprofessional participants who were currently in these roles noted that they felt they did not have enough contact with or support from special education teachers.

To help support paraprofessionals in these roles and address one of the most significant barriers to job satisfaction for these employees, schools might want to consider implementing a rotating schedule. Through proper scheduling, one-to-one and ABA assistants could be rotated with other program assistants throughout the day to prevent task redundancy and burnout from working with the same student, especially since these students often have some of the most challenging academic needs and behaviors. Paraprofessionals who were currently in these positions also noted discontent with the limited interactions that they had with their supervising special educators. This is yet another reason why districts should be mindful of the need for teachers to have time to meet with and provide ongoing training and support for paraprofessionals.

The responses from paraprofessionals and administrators in this study reveal that districts are taking some of the necessary steps to retain paraprofessionals. Although some of the strategies districts frequently used to retain staff were aligned with the needs and desires of paraprofessionals, some other strategies that were less frequently noted were related to some of the most highly coded areas for job dissatisfaction and turnover. For example, only two of the nine administrators throughout the districts noted that they provided paraprofessionals with choices for in-district professional development, yet irrelevant professional development was the most highly coded aspect of the job that did not appeal to paraprofessionals. Also, only two administrators said that they required special educators and paraprofessionals to meet regularly, yet not having enough time with special educators was another highly coded aspect of the position that did not appeal to paraprofessionals.

By becoming more familiar with the aspects of the job that appeal and do not appeal to paraprofessionals, administrators can take steps to providing supports that increase the likelihood of job satisfaction and retention. Special education administrators and principals should continue to inquire about the reasons for turnover in their schools. Intermittent surveys as well as exit interviews could provide valuable and district-specific data about aspects of the position that lead to paraprofessional retention and turnover. Additionally, when making decisions about placements districts should continue to solicit feedback from paraprofessionals. Although many of the administrators asked supervising special educators their ideas about future placements for teacher assistants, they also asked the paraprofessionals.

Administrators do not work within the classrooms so they may not always be aware of how teams of teachers and paraprofessionals are working together, but by asking both parties they can gain a more holistic picture of how teams are functioning and servicing students. Soliciting feedback from paraprofessionals would also enable them to make more informed decisions about future placements and perhaps encourage retention by keeping together strong teams that have developed cooperative and effective working relationships. Even paraprofessionals who worked with the most challenging student populations noted that they were most encouraged to stay because they had the opportunity to continue working with familiar colleagues. Decisions for placements should always focus first on what is best for students and programs, and changes often must occur even in the best of teams. However, if current teams are working well together and effectively servicing students, administrators should keep in mind that by honoring paraprofessional requests to work with certain teams they could be taking steps to increase retention.
**Atypical Observation—Reported Leaver Characteristics and Possible Future Leavers**

An atypical observation is one that warrants caution. Some of the results were based on what participants recalled about paraprofessional leavers and not from the leavers themselves. Unlike the other observations, the information for this one emerged partly from secondary sources, or accounts from current administrative and paraprofessional participants. This observation also tied together several findings that emerged from the study in an attempt to understand the nature and future of paraprofessional employment. This observation is not considered beyond dispute, but includes a sequence of findings that are evidenced throughout the cross-case analysis.

This observation begins with the finding that most paraprofessionals tend to be college educated with training in many different fields outside of education. As the economy changes and financial needs in the household change paraprofessionals must often leave their current positions to pursue higher paying jobs. From the coded participant responses, paraprofessional turnover and retention also appears to rely heavily on the economy and personal financial status.

There were some commonly coded characteristics of leavers that were reported by paraprofessional and administrative participants in this study. Of the 21 paraprofessional and administrative sources, 13 sources made 17 references about paraprofessionals who chose to leave the position so that they could pursue another career. They noted that the choice to become employed as a paraprofessional was a convenient but temporary decision as they took the steps needed to gain employment in their true career. The reasons discussed in at least half of the participant sources were the need for a higher salary. Of the 21 sources, 12 sources made 20 references about people who had left the position because of their need to make a higher salary. Participants in 11 sources made 13 references about paraprofessionals who left because they were pursuing a degree in education or employment as a teacher. Some paraprofessionals noted that with school hours leavers were able to easily attend night classes and take summer courses. Others maintained that leavers were actively seeking out other positions from the start, and that this was a convenient way to make a little extra money until they had found the right job.

The observation that emerged from this study revealed that there had been some common characteristics of leavers in the past, but that some of these characteristics are becoming more common among all paraprofessionals. The most prevalent of these characteristics included the need for paraprofessionals to obtain higher paying jobs. Stayers have noted that for years they have experienced a period of relative economic stability, most of whom reported an adequate secondary household income. Many paraprofessional participants now reported that this stability no longer existed and they needed more money to pay for household expenses and college for their children. Others talked about significant losses in their household retirement funds due to the economy and the need to start saving more money than they were currently able to in this position. In fact, at the time of this study 35% of stayers noted that they would have to leave because of recent financial losses, increases in financial needs, or because their spouses had lost their jobs.

Although this observation was partly based on information collected about leavers, it also includes what current paraprofessionals had to say about the likelihood of remaining in the position. When participants were asked about the likelihood of future employment in their districts, only 38% noted that they had planned on staying. Table 8 outlines the coded responses of paraprofessionals concerning employment in the district the next one to five years.

Of the 37 paraprofessional participants 38% noted that they had planned to leave their district sometime in the next one to five years to pursue higher paying jobs. This included half of the total participants from Holmfield, 36% of the participants from Crestfield, and 27% of the participants from Smithfield. Although at the time of this study many of the paraprofessionals had a stable secondary household income, seventy percent of the stayer paraprofessionals also noted that if their

<table>
<thead>
<tr>
<th></th>
<th>Total (37 paras)</th>
<th>Newbies (17 paras)</th>
<th>Stayers (20 paras)</th>
<th>Holmfield (12 paras)</th>
<th>Crestfield (14 paras)</th>
<th>Smithfield (11 paras)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Staying</strong></td>
<td>38%</td>
<td>35%</td>
<td>40%</td>
<td>17%</td>
<td>43%</td>
<td>55%</td>
</tr>
<tr>
<td><strong>Leaving for higher paying job</strong></td>
<td>38%</td>
<td>41%</td>
<td>35%</td>
<td>50%</td>
<td>36%</td>
<td>27%</td>
</tr>
<tr>
<td><strong>Retired</strong></td>
<td>10%</td>
<td>0%</td>
<td>20%</td>
<td>25%</td>
<td>7%</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Unknown</strong></td>
<td>14%</td>
<td>24%</td>
<td>5%</td>
<td>8%</td>
<td>14%</td>
<td>18%</td>
</tr>
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secondary income were to decrease or be eliminated, they would not be able to remain in this position as they would be forced to seek out a higher paying job.

Although paraprofessional responsibilities have shifted from clerical and supportive in nature to spending a great deal of their time making primary and often independent instructional decisions for students with special needs, many paraprofessionals feel that they are not being compensated for this increased level of responsibility. Many stayer paraprofessionals noted that they had settled for the minimal income, claiming that they did not take the position for monetary reasons. Many of these stayers maintained that they could no longer settle for the minimal pay, especially since their responsibilities had increased each year. Because of the recent economic downturn, it is anticipated that paraprofessionals will continue to leave to pursue higher paying careers. Policies that focus on employing and appropriately compensating high quality paraprofessional employees are necessary. Districts will need to respond to paraprofessional turnover and make efforts to sustain a more experienced and quality workforce.

**AREAS FOR FUTURE STUDY**

At this time Massachusetts does not collect any type of paraprofessional turnover data, although attrition data is collected about teachers in all content fields, including special educators. A larger study might reveal other factors at work that relate to paraprofessional turnover and retention. It would be advisable to conduct a broad-scale study that focuses on the factors that lead to turnover and retention and the strategies that schools use to retain staff. A study like this would identify districts with higher rates of retention so that all schools could have more strategies to try in their attempts to retain their paraprofessional workforce.

In addition to larger studies, a comprehensive cost analysis of turnover and retention should be conducted. This analysis should not only focus on a breakdown costs related to paraprofessional turnover, but it should also examine the potential cost savings to be realized by reallocating resources in an attempt to retain staff. If districts had an idea of the financial impact of turnover, they can make more informed decisions about paraprofessional resource allocation and expenditures.

It is unclear from the data collected in this investigation whether new staff, seasoned paraprofessionals, or those who had left the school system were more effective in their support of students with special needs. A study that investigates paraprofessional efficacy may help identify the effect that these employees have on the academic performance of students with special needs. Finally, exit interview studies should be conducted with paraprofessionals who are leaving the field. This can help to develop a more conclusive picture of turnover from first-hand accounts.

**CONCLUSION**

The negative effects of turnover are well documented, but schools can introduce additional conditions that increase the likelihood of retention. Findings from this study suggest that additional efforts need to be directed toward purposeful professional development, collaborative interactions, appropriate compensation, and ongoing supports for paraprofessionals. These opportunities should allow paraprofessionals some of the same professional development choices as teachers. These important service providers are no longer clerical assistants or back-up support. Their jobs are demanding and they carry out much of the same direct instructional, social, self-care, and behavioral supports that teachers do each day. Districts should provide paraprofessionals with ongoing supports and opportunities to enhance their teaching skills in content areas and assist them in ways that are relevant to their caseload assignments.

**References**


Individuals with Disabilities Education Act Amendments of 1997, 105th Congress, 1st session.


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ABSTRACT

Culturally responsive teaching is one effort to achieve educational equity amidst a demographic shift in today's classrooms; students are increasingly diverse and the teaching force remains predominately white, middle-class and monolingual. Essential to culturally responsive teaching is conceptualizing cultural differences as complex and appreciating how culture influences teaching and learning. This mixed method case study is part of a larger study investigating how three white middle-class teachers' conceptualized cultural differences over the course of a culminating field-experience. Informed by a cultural competence developmental model, this study examined how one white, middle-class male's understandings of cultural differences changed throughout a semester-long, field-experience experience in a school site with a culturally diverse student body. The participant's conceptions of cultural differences were assessed before and after the student-teaching experience with an inventory and semi-structured interviews. Results indicated decreased ethno-centrism and less severe stereotyping following student-teaching. Cultural self-awareness and the opportunity to observe and reflect as potential tools for change are discussed.

INTRODUCTION

“Even without our being consciously aware of it, culture determines how we think, believe, and behave, and these, in turn, affect how we teach and learn” (Gay, 2000, p. 9).

The influence of culture in teaching and learning has received increased attention as students in K–12 classrooms represent an increasingly culturally diverse demographic, while students in college classrooms preparing for a career in teaching are predominately white, female, and middle class (Ladson-Billings, 1994; Zeichner, 2003). Diller (2007) defines culture as “a lens through which life is perceived” (p. 4) or what Bennett and Bennett (2004) refer to as subjective culture. Thus, it is not simply cultural affiliations that present implications for teaching and learning, but the range in communication styles, language use, prior knowledge, and frames of reference that are associated with cultural diversity that influence teaching and learning (Banks et al., 2005). The lack of diversity among pre-service teachers, coupled with increasing diversity among students and families poses potential negative outcomes for teaching and learning unless teachers become culturally responsive (Villegas & Lucas, 2002). Many multicultural education scholars regard culturally responsive teaching practices as a potent lever for dismantling persistent educational inequities enacted through classroom practice (Gay, 2001; Ladson-Billings, 1994; Villegas & Lucas, 2002). Finally, the need for culturally responsive teachers will grow in the upcoming decades as demographic trends continue (Banks et al., 2005).

Teachers of high-achieving non-mainstream students possess a knowledge base and skill set often referred to as culturally responsive teaching (Gay, 2000; Villegas & Lucas, 2002), Culturally Relevant Pedagogy (Ladson-Billings, 1994) or multicultural competence (McGee Banks, 2001). Culturally responsive teaching practices include identifying cultural differences as resources for instruction rather than unchangeable deficits (Banks et al., 2005; Gay, 2000; Ladson-Billings, 1994; McGee Banks, 2001; Zeichner, 2003), tapping into students' prior knowledge, considering myriad ways students perceive school, including the teacher, (Bransford, Darling-Hammond, & LePage, 2005) and holding high expectations of all students (Ancess, 2003; Gay, 2000; Ladson-Billings, 2001).

RELATED LITERATURE: UNDERSTANDING CULTURE

Understanding culture is necessary for culturally responsive teaching. According to Ladson-Billings (2001) one indicator of cultural competence is “understanding culture and its role in education” (p. 98). Understanding culture, including, recognizing its complexity and pervasiveness, allows teachers to recognize schools as microcosms of mainstream culture and therefore explicitly communicate mainstream cultural school expectations to non-mainstream students rather than regard schools as culturally neutral contexts (Au, 2006; Gay, 2000; Ladson-Billings, 2001; Villegas & Lucas, 2002). Thus, teachers' acknowledgement of structural inequities and privilege inform culturally competent teaching.

Cultural self-awareness or recognition of how one's culture influences one's outlook or worldview and behaviors is also part of cultural understanding. This knowledge requires recognition of oneself as a multicultural being in various contexts (Howard, 2006; Ladson-Billings, 2001; Villegas & Lucas, 2002). Identifying culture bound values and behaviors within oneself and others serves as a foundation for building teaching skills.
associated with high academic achievement among culturally diverse students (Ladson-Billings, 1994).

**Theoretical Framework: Understanding Culture Through a Developmental Lens**

How do pre-service teachers change or maintain their understanding of culture and its role in education? The potential trajectory of understanding cultural differences with increasing complexity is outlined in Bennett’s (1993) Developmental Model of Intercultural Sensitivity (DMIS). Developmental models help teacher educators interpret pre-service teachers’ varying responses to multicultural coursework or field experiences. Through an explanation of how pre-service and in-service teachers’ understanding of culture is changed or maintained over time, teacher educators can better assess future teachers, plan coursework, and evaluate learning activities (McAllister & Irvine, 2000; Van Hook, 2000).

Similar to cultural competence, intercultural competence is comprised of cultural self-awareness, non-evaluative perception, cross-cultural empathy, and cultural adaptation strategies (Bennett, 1998). Changes in cultural self-awareness, non-evaluative perception, and cross-cultural empathy depend upon the meaning people attach to their experiences with cultural differences, or their cultural adaptation strategies. As a person experiences cultural differences with increased complexity, cultural self-awareness, non-evaluative perception, and cross-cultural empathy are also likely to increase (Bennett & Bennett, 2004). Cultural adaptation is a process whereby “one’s worldview” is augmented to include both values and beliefs of one’s own culture as well as the values and beliefs of another culture (Bennett, 1998, p. 25).

Bennett (1993) initially constructed the Developmental Model of Intercultural Sensitivity (DMIS) to describe observational and self-report data gathered from students studying or working abroad. A grounded theory, the DMIS depicts the development of intercultural competence through six stages. Each stage describes a deeper, more complex understanding of cultural differences and potential for culturally adaptive behaviors. As the orientation towards cultural differences, or “worldview configuration” becomes increasingly complex and differentiated, cultural adaptation is augmented through expanded perspective-taking and communication skills (Hammer, Bennett, Wiseman, 2003). Worldview configuration growth is marked by stages, where one moves from ethnocentric to ethno-relative views of cultural difference (Bennett, 1998).

**Underlying Assumptions and Concepts**

Bennett (1998) conceives intercultural competence as dynamic: growth is always possible and may continue throughout life. A change in attitude or behavior indicates a developmental change. Attitude and behavioral changes reflect changes in “cognitive structure” or worldview configuration (Bennett & Bennett, 2001). Varying levels of understanding, behaviors, and attitudes represent particular stages (Hammer et al., 2003). Bennett (1993) ascribed the terms “intercultural mindset” and “skillset” to denote their connection (p. 7). Mindset encompasses cultural awareness and “attitudes such as curiosity and tolerance for ambiguity that act as motivators for seeking out cultural differences” (p. 7). Thus, a changing perception, moving from an ethnocentric mindset to an ethno-relative mindset, indicates intercultural development (Bennett, 1993). Accompanied by a heightening awareness of cultural differences, the “skillset” includes the ability to “analyze interaction, predict misunderstanding, and fashion adaptive behavior” (p. 7).

**Stages of Intercultural Sensitivity**

According to Bennett (1993) an individual’s worldview is represented through one of six stages, or orientations towards cultural differences, evenly separated along a continuum separated by the following two endpoints: ethnocentrism and ethno-relativism. Accompanying each stage is one or more characteristics and one or more developmental tasks to overcome before transitioning to the next. The first stage, Denial indicates the lowest level of intercultural sensitivity and is not common. A lack of knowledge about “other” cultures is the hallmark of the Denial stage. Given the changing demographics of today, Denial is rare, although arguably can be maintained through psychological and physical distancing (Hammer & Bennett, 1998, 2001). Acknowledging cultural differences is the developmental task facing those in this stage.

The second ethnocentric stage is Defense. In this stage, one acknowledges cultural differences but perceives them as threatening, leading to polarized thoughts, attitudes, and behaviors that may manifest in two different ways. One manifestation is an “us” against “them” mental stance where a sense of superiority experienced when comparing one’s culture to another. While cultural differences are acknowledged in this stage, they are not highly differentiated. Rather, broad categorizations of “good” and “bad” or “us” versus “them” persist without a more complex understanding of culture. The
other potential manifestation of the Defense stage is Reversal. Also of note with Reversal is the identification with another cultural group perceived as superior to one's own resulting in idealization. Similar to Defense, the understanding of cultural differences is simplistic; there is no recognition that all cultural groups are beset with problems or difficulties. Thus, the developmental task in this stage is to decrease hostility toward another culture or one's own and recognize no one cultural group is superior to another (Bennett, 1998). A perspective that all people are generally the same regardless of culture moves one to the Minimization stage.

The midpoint of the ethnocentric and ethnorelative continuum is Minimization. Although the superior status of one culture over another in Defense is resolved, in Minimization there is a strong emphasis on the commonalities among all people does not allow for the consideration of cultural differences beyond what is visible. Moreover, in an ethnocentric fashion, those in Minimization tend to presume that others see cultural differences in the same way and an assumed shared worldview prevails. This perceived commonality often results in “disavowal of power” making it difficult to acknowledge privileges and social stratification associated with cultural affiliations (Bennett, 2004, p. 21). Another common manifestation of this stage is to claim to be “colorblind,” and regard it as a sign of cultural competence. The main developmental task at this stage is to continue to recognize commonalities, while also recognizing less visible, more complex aspects of cultural differences (Hammer, 2007).

Stage four, Acceptance is marked by a perspective taking ability in response to a deepened understanding of culture within contexts (Bennett & Bennett, 2001). The Acceptance “worldview” incorporates more subtle and complex cultural differences, resulting in cultural curiosity; however, there may be little action taken in response to this curiosity. Furthermore, categorizations of culture are differentiated enough to consider a situation through the perspective of another cultural orientation resulting in relativistic thinking, where perspective are apprised in relation to their cultural worldview (Hammer et al., 2003).

The Adaptation stage is characterized by deliberate perspective-taking skills that have become more ingrained to inform behavioral skills. The ability to engage in “behavioral code-shifting,” where one adopts behaviors appropriate for a particular cultural context marks the Adaptation stage (Bennett, 2004). Growth will continue in this stage if one continuously seeks to act on his or her cultural empathy and expands context congruent behaviors (Bennett, 1993).

Integration is the last ethno-relative stage on the continuum highlight how a highly differentiated understanding of cultural differences influences identity. Individuals in Integration synthesize the multiple cultural perspectives with which they are familiar and often identify themselves as bicultural or multicultural. As they participate in multiple cultural contexts, individuals develop identities drawing from more than one culture (Hammer & Bennett, 1998, 2001).

Although intercultural competence may continue through the Integration stage, can one regress in the development of intercultural competence? According to Hammer et al. (2003) particular conditions, such as those that are experienced as stressful, may renew a “worldview configuration” or way of understanding cultural difference that resembles the stage that precedes the current stage. For example, one may be in the Adaptation stage, but temporarily exhibit behaviors and attitudes or “trailing issues” associated with Minimization when facing a stressful situation. Thus, situational factors may exert a temporary influence on intercultural development (Hammer, 2007).

**Understanding Culture and Teacher Education**

Ladson-Billing’s (2001) cultural competence indicator for pre- and in-service teachers and Bennett’s Intercultural Communication perspective provide a description of cultural competence and its development. Ladson-Billing describes the culturally competent teacher as one who comprehends culture and recognizes its presence in education. Given the role of teacher’s understanding cultural differences in teaching and learning and its implications for instruction and learning, describing myriad ways people interpret or understand cultural differences is essential for teacher education aimed at fostering culturally responsive teaching.

**Statement of the Problem and Significance of the Study**

Demographic trends highlight the need for pre-service teacher education programs to foster the knowledge and skills necessary for effective teaching practice with non-mainstream students (Banks et al., 2005; Villegas & Lucas, 2002). Investigations of pre-service teacher preparation programs have predominately focused on classroom activities designed to induce attitude shifts about cultural differences (Atkinson & Gabbard, 2003; Brown, 2004; Lenski, Crumpler, Staliworth, & Crawford, 2005), brief field experiences (Barnes, 2006; Cooper, 2003; Dalhouse & Dalhouse, 2006; Sleeter, 1992), or personal attributes and experiences pre-serv-
ice teachers bring to their educational experiences (Garmon, 2004; Husebosch & Koerner, 1993). There is scant research examining how pre-service teachers view cultural differences and their role in education over the course of a culminating field experience in a school with a diverse student body. If teacher preparation programs aim to promote cultural competence among pre-service teachers, pre-service teachers’ views of cultural differences within the contexts of a multicultural field experiences must be further understood.

This paper is part of a collective case study examining three pre-service teachers understanding of socioeconomic and ethnic differences and their role in the education. The study contributes to a small but growing body of research investigating pre-service teachers’ cultural competence in conjunction with their field experiences. Information about pre-service teachers’ experiences can inform teacher education programs as a means to improving instruction for culturally diverse learners. Finally, in their review of research on teacher education courses and field experiences, Clift and Brady (2005) called for research that included the perspectives of pre-service teachers. This study is a small step toward responding to this call.

METHOD

RESEARCH QUESTIONS

1. Before and after a culminating field experience, (i.e., student teaching) how do pre-service teachers describe their understanding of general cultural differences?
2. Before and after a culminating field experience, (i.e., student teaching) how do pre-service teachers describe their understanding of socioeconomic differences and their role in education?

DESIGN

Researchers utilize case study design to understand a unique case or to learn more about an issue or phenomenon by examining one or more cases where the issue or phenomenon is present. A collective instrumental case study design was utilized to investigate the development pre-service teachers’ views of cultural differences in the context of a student teaching experience in a school with culturally diverse students. Instrumental case studies allow the researcher to examine an issue or phenomena through a particular case or cases (Stake, 1995). The pre-service teacher described in this paper served as the unit of analysis (Yin, 2003) and therefore constituted a case.

PARTICIPANTS

A criterion sampling strategy was employed for participant selection. Pre-service teachers who were completing a master’s degree program, seeking state initial licensure and planning to complete their student teaching in middle or secondary school placements where at least 30% of the student body was identified as non-mainstream in terms of race/ethnicity or social class were selected for the study. One of three participants, “Dave” is described.

MEASURES

The Intercultural Development Inventory (IDI). The IDI is designed to detect a respondent’s orientation towards cultural differences or worldview as outlined by the Developmental Model of Intercultural Sensitivity (DMIS) including the developmental tasks to further intercultural sensitivity. The IDI is comprised of 50 statements about cultural differences. Participants are instructed to think about cultural affiliations to which they feel they belong as “my culture” and those they do not as “other cultures”. Respondents indicate their level of agreement with each statement using a five point Likert scale ranging from 1 (disagree) to 5 (agree) before completing a brief demographics section. The IDI is not subject to social desirability, is reliable, and its scales provide a generally accurate measure of the DMIS model (Hammer et al., 2003; Paige, Jacobs-Cassuto, Yershova, & Dejaeghere, 2003).

Results of the IDI yield an overall Developmental Intercultural Sensitivity (DS) profile providing a score that places respondents within, or between, orientations to cultural differences that are on the DMIS as well as the specific developmental issues associated with each orientation. While the IDI provides detailed individual profiles, it also has limitations. The IDI does not provide a measure of orientations toward specific cultural affiliations such as race/ethnicity, gender or social class. IDI items contain the broad term “cultural differences” and respondents are instructed to think of cultural differences according to the cultural groups with which they identify, noting that this is often an ethnic or national affiliation (Hammer & Bennett, 1998, 2001). However, the ways in which people tend to construe cultural differences on the IDI tends to be consistent across types of differences or cultural affiliations (Hammer et al., 2003). To address this potential limitation, interview questions addressing specific cultural differences such as social class within educational contexts were posed in the semi-structured interviews.

Semi-structured interviews. Two semi-structured
Annual Colloquium Journal vol. XV, Spring 2010

Interviews were developed to describe participants’ understanding of socioeconomic differences and their role in education before and after their student teaching experiences. Semi-structured interviews contained modified “contextualizing questions” adapted from IDI interview protocol (Hammer et al., 2003). Interview questions regarding socioeconomic differences afforded an opportunity to consider participants’ IDI responses regarding overall cultural differences in conjunction with an aspect of cultural diversity discussed in this paper, namely social class. The first interview questions focused on pre-service teachers’ prior knowledge and experience with social class differences and their role in education while the second interview questions emphasized pre-service teachers’ student teaching experiences and views of socioeconomic differences.

**Procedures**

The pre-service teacher participant completed the IDI and the first semi-structured interview one week before embarking on his student teaching and again immediately following his semester long student teaching experience. The IDI was completed in pencil-paper format and interviews were audio-taped. All measures were administered by the same researcher.

**Data Analysis**

IDI scores and Worldview Profiles were calculated with IDI software. For IDI analysis, IDI Developmental score (DS) situates the participant within a DMIS stage which also indicates degrees of ethnocentrism or ethnorelativism. The IDI Worldview Profiles outlining participants’ progress on the developmental issues associated with each DMIS stage were examined. The Developmental score (DS) continuum is situated within the DMIS stage continuum and the Worldview Profile displays the five IDI subscales and their developmental issues. Developmental issues associated with each stage are reported numerically and categorized along a continuum: 1-2.33 unresolved, 2.34-3.66 in transition or 3.67-5 resolved (See Figure 1). A score within “resolved” suggested that the respondent was addressing the developmental issue with increasing consistency while “unresolved” indicated lack of awareness.

Interview data were analyzed with NVivo 8.0 software, utilizing predetermined and emerging coding strategies. Broad codes included DMIS stage characteristics and memos were created to note potential emerging themes.

**Description of Case and Contexts**

Background information for the participant was drawn from interview and IDI demographic data. Background information here includes the circumstances under which the participant entered the college and his or her student teaching school site, as well as prior experiences teaching across cultural differences.

**Participant, College, and School Site Contexts**

Dave is in his twenties and identified his ethnicity as Italian American on the IDI. During his initial interview he identified himself as “American” and middle class. He reported no prior experience living in “another culture.” He was enrolled in Favorton College Graduate School of Education (GSE) master’s degree program, preparing to teach history in secondary education. Dave first entered Favorton as an undergraduate student, where he learned about the GSE. Upon graduation from the undergraduate program as a history major, he was accepted to the GSE’s master’s program leading to initial state teaching licensure.

Dave reported prior experience teaching as a teaching assistant in a public urban middle school. He worked in two classrooms for approximately 20 hours per week for an academic year. He described the student body demographic as “varied.” In addition to his history coursework Dave completed a required GSE diversity course aimed at providing students with knowledge, skills, and attitudes necessary to address varying needs of all public students to prevent academic failure. An emphasis on teachers’ responsibilities to respond to oppressed groups was evident in the course syllabus and by Dave in his first interview.

The secondary education public school site where Dave completed his student teaching served approximately 2,000 students pursuing vocational and academic studies. School enrollment data indicate that slightly over 50% of the students qualified for free or reduced lunch and just less than 50% were identified as Asian,
Hispanic, African American or Multi-racial during the academic year Dave completed his student teaching.

RESULTS

IDI DATA: UNDERSTANDING GENERAL CULTURAL DIFFERENCES

When Dave first took the IDI before his student teaching his DS score was 73.94. This score indicated he was slightly beyond the midpoint of the Denial/Defense-Reversal (DD-R) DMIS worldview and was at the cusp of the Minimization (M) stage at the end of student teaching. When Dave took the IDI again his DS was 83.19. This 10 point increase, close to one standard deviation, indicated a slight decrease in ethnocentrism and progress from Defense/Reversal towards Minimization (Figure 1).

IDI and Denial. Findings from the IDI Worldview Profile pinpoint Dave’s scores on Defense Denial-Reversal (DD-R) clusters which represent developmental issues associated with Defense and Denial. The Worldview Profile outlines cluster scores to see which DD-R characteristics were maintained or slightly changed. The DD scale encompasses two clusters representing Denial related issues: Disinterest in and Avoidance of interactions with cultural differences. Dave’s Worldview profile indicated he entered student teaching having “resolved” these two issues; however, the subscale scores differed slightly, indicating varying degrees of resolution. Close to the highest possible score of five, his subscale Avoidance scores were 4.67 before student teaching and 4.87 after, firmly placing him in the “resolved” category for this developmental issue. In contrast, Dave’s Disinterest subscale score was somewhat less stable.

Upon entering student teaching his Disinterest in cultural differences score was 3.75 placing him slightly beyond “resolved” while his second score of 4.25 suggests progression within the “resolved” range. The modest increase following his student teaching highlights decreased withdrawal from cultural differences via Disinterest.

IDI Defense and Reversal. IDI Worldview Profile data indicate Dave was aware of cultural differences; however his scores in Defense and Reversal were associated with interpreting cultural differences through “us/them” categories. Defense subscale scores of 3.33 (Time 1) and 3.17 (Time 2) and Reversal scores of 3.36 and 3.56 indicate Dave was “in transition” with regard to categorizing cultural differences through oversimplified “us” and “them” dichotomies. Dave exhibited a pattern of partial agreement with items conveying “us” as better than “them” or “other”. For example, he indicated some agreement with statements reflecting superiority of his culture before student teaching, and then indicated partial agreement and disagreement with the statement following his student teaching. Similarly, he indicated full and partial agreement with statements from the Reversal subscale. Following student teaching similar scores in Reversal and Defense indicate that Dave was aware of surface cultural differences accompanied by a tendency to construe cultural differences into “us” and “them” categories, viewing them either in a negative or positive light. This tendency serves as a barrier to recognizing how negative and positive qualities coexist within all cultures. (Hammer & Bennett, 1998). IDI data are displayed numerically and in the form of horizontal bars along subscale and developmental issue continuums (Figure 2).

IDI data are displayed numerically and in the form of horizontal bars along subscale and developmental issue continuums (Figure 2).

While the IDI indicated how Dave understood general cultural differences qualitative data revealed Dave’s orientation towards socioeconomic differences between students and teachers and their role in teaching and learning. The following section presents Dave’s understandings of socioeconomic differences from interview data as they relate to DMIS stage characteristics and frequencies. Descriptions of how his understandings changed and remained stable over the course of his student teaching are also included.

CULTURAL DIFFERENCES AND THEIR ROLE IN EDUCATION: DMIS QUALITATIVE DATA

Before and after student teaching, Dave made statements about socioeconomic differences and their role in education that reflected characteristics of Defense, Reversal, and Minimization. Taken together, statements reflecting characteristics of Defense and Reversal were twice as frequent as statements reflecting Minimization. DMIS stage characteristics identified from interview data before and after student teaching as they pertained to his understanding of socioeconomic differences and
their role in education are described.

**Defense and Negative Stereotypes.** Several of Dave's interview statements regarding students whom he perceived as high or low socioeconomic status reflected negative stereotypes of “other” cultural groups, one characteristic of Defense. In response to interview questions regarding SES differences prior to student teaching, Dave made four statements that were peppered with negative stereotypes about students living in low income or wealthy households. For example, in his response to how socioeconomic differences between teachers and students influence teaching and learning before student teaching Dave noted, “You see generally the poorer population has difficulty reading. They are not taught to read; they don't read at home.” Similarly he described a wealthy family that “would either have a nanny who had some education or their parents would be home and it was more important for them to do their homework than hang out with their friends out on the street on the stoop.” Both of these statements contain negative stereotypes and imply deficits in behavior or values.

**Reversal and Positive Stereotyping.** Dave seemed to counterbalance negative stereotypes associated with the “wealthy class” with positive stereotypes of middle and low class status, a characteristic of Reversal. He made statements reflecting a negative stereotype he held about the values and behaviors of high income students both before and after his student teaching while making statements reflecting a positive stereotype about middle to low income students. Notably, Dave seemed to associate socioeconomic differences with differences in educational values, specifically regarding the purpose of education and the role of teachers. Part of Dave’s response to the interview question about the opportunities for teaching and learning when there were socioeconomic differences between teachers and students, included:

Lower socioeconomic students probably, if they have nothing else to worry about, do value education more, I think, because they know that that might be their one way out, to improve. You know whereas wealthy kids might sometimes just take it for granted. I think sometimes they’re the type of kids that say when they fail a class, “the teacher failed me.” Whereas, a lower socioeconomic student says they failed the class, ‘Oh well maybe I didn’t do enough.’ But I think they are more willing to help whereas the upper socioeconomic student thinks they should be helped.

Perhaps as an outgrowth of his perception of how middle and low income students value education, Dave perceived his school site students as a more desirable school in which to teach compared to a school site with economically privileged students. During his second interview, Dave concluded,

.... these kids [referring to students in his school site] I’d much rather teach kids like that than kids that are well off that, who would rather not listen to you at all, because these kids really embrace, people that respect and listen to them, I tried my best to respect them and listen what their opinions were.

Dave associated an appreciation for the value of hard work and education with middle and low socioeconomic status, and identified this as a shared value with his students. He expressed hope for his students at his school site to realize upward mobility, but noted that not everyone could alter the effects of social class stratification. This was reflected in interview data where Dave made statements that were arguably contradictory before and after his student teaching. For example, when comparing himself to his students he remarked:

...that's the life that they [school site students] live sometimes they can't get out of it but you know uhm...the neat thing about the high school I taught is it’s a vocational high school so they are all learning such a trade skill, you know. Once they graduate they can go right into the work place and make a good amount of money, they're going to be making more that I will.

Dave acknowledged that not everyone realized upward mobility, but seemed reassured school site students would given their vocational training.

**Diffusing Defense and Reversal.** Following his student teaching, Dave made no stereotyped statements without questioning them aloud during the second interview. His descriptions of students seemed less stark, and he described how he was questioning his notions of socioeconomic status after observing or interacting with school site students. For instance, when asked about what hindered him from getting to know his students’ socioeconomic status, he expressed a negative stereotype about low income students and cell phone ownership.

You don't need a cell phone if you can't pay heat. I think a lot of these kids are in a situation like that, they live in a two family house, with overcrowded, single-parent families that are working but they have cell phones. And we know that, but it's, I don't know.
Dave viewed cell phones as an “extra” and therefore assumed cell phone ownership did not indicate limited income. However, cell phone ownership was so pervasive among his school site students he became unsatisfied with his assumption that cell phones served as an accurate indicator of income. Dave reflected:

…I don’t know, sometimes it’s hard to tell because as I said the cell phone thing every kid has a cell phone, it’s like the weird extras that kids have that people have that you’d never really know unless you really went home with them or saw where they live and all that.

Dave did not relinquish his understanding of cell phone ownership as an “extra” but referred to them as “weird extras” perhaps beginning to acknowledge the limitations of his explanation and recognizing his ethnocentrism. In addition to rethinking cell phone ownership as an indicator, Dave seemed to arrive at a more differentiated notion of “normalcy” when describing his students. As previously discussed, he recognized his economic privilege when he termed many of the things he had growing up as “extras”. Through this comparison, Dave seemed to arrive at an additional definition of “normal” when describing school site students.

At open house one girl had her grandparents come, one of their grandfather’s in a wheelchair. I mean, it’s like sometimes the school obviously is trying to be this girl’s priority but she has a lot of other stuff going on. Where I was growing up, there was school, I was playing with my friends after school, I was playing sports, these kids don’t have any time for any of that. But it is remarkable too that they still do it. They still function, they are still normal kids. It’s kind of an eye opener, it was good.

While Dave assumed students did not have time for recreational activities, he seemed to question his underlying assumption that socioeconomic differences were equated with difficulty functioning.

Although Denial and Defense-Reversal and Minimization are all considered ethnocentric stages, several characteristics of Minimization appear as direct manifestations of ethnocentrism. One manifestation of ethnocentrism in Minimization is the tendency to emphasize similarities between “other” and oneself thereby avoiding difference (Bennett & Bennett, 2004). Dave drew several similarities between himself and his students when asked about socioeconomic differences. Minimization, “Valuing Hard Work” and Recognizing Privilege. Reflecting on his student teaching experiences, Dave emphasized sharing a similar work ethic with his students. When describing school site students whom he perceived as low income, he noted that “we both know the value of hard work.” He seemed to construct this perceived similarity with his school site students by contrasting himself and his school site students with the “wealthy class.” Before and after his student teaching he noted that the “wealthy class” did not know the value of hard work to the extent of the middle and lower class students. This statement reflects a Defense stage stereotype that was perhaps conducive to likening his experiences to school site students’ experiences. After his student teaching, Dave identified similarities; however these were accompanied by parallel differences and contradictions.

During the second interview Dave simultaneously considered similarities and differences when discussing school site students. For example, when asked about the differences between himself and his students following his student teaching, he noted similarity through temporary “struggles with making the rent, paying bills, getting food just trying to stay afloat” as a student teacher. However, Dave quickly qualified the similarity with a notable difference, “My students, their family obviously they live like that year round, that’s their life that’s how they’ve been brought up.” Dave recognized that his privilege remained in spite of his temporary limited income and prevented him from overlooking a crucial difference.

**DISCUSSION**

Dave’s understanding of cultural differences appeared to deepen and become slightly more differentiated during his student teaching experience. Dave’s IDI profile indicated that prior to student teaching he was situated in the Denial/Defense stage. He was continuing to resolve the issues of Avoidance and Disinterest associated with Denial. Dave’s orientation towards cultural differences in Defense and Reversal indicated that he attended to surface cultural differences and interpreted them through rigid dichotomies of “us” and “them,” disproportionately ascribing negative or positive appraisals to one or the other. Therefore, to move into Minimization, Dave’s developmental task was to increase his awareness of commonalities amidst perceived cultural differences. Following his student teaching, IDI data indicated he moved toward the cusp of Minimization.

Qualitative data were congruent with IDI data; Dave made more statements reflecting Defense and Reversal than Minimization. Qualitative data also revealed how Dave reasoned about socioeconomic dif-
ferences, yielding examples of how he began to question and loosen some of his negative stereotypes regarding low socioeconomic status and its role in education. Before he entered student teaching, Dave indicated predominantly negative stereotypes when discussing low or high income students, a characteristic of Defense. When Dave compared his experiences to school site students through a socioeconomic lens following his student teaching, a notable characteristic of Minimization emerged. His positive stereotypes of low income school site students reflected his ethnocentrism through an emphasis on similar values. He asserted that his students, like him, shared “the value of hard work,” were afforded educational opportunities to realize upward mobility, and therefore regarded teachers as worthy of respect and gratitude. This is in contrast to the “entitlement” he associated with the “wealthy class.” As Bennett and Bennett (2004) noted of Minimization: “The attribution of similar needs, desires, and values to others in fact moves simplification to a higher level of abstraction. Now it is not the people who are simplified but cultural difference itself that is subsumed into the familiarity of one’s own worldview” (p. 155).

The DMIS indicates the need for intercultural experiences and a deepening understanding of cultural differences to foster intercultural competence (Hammer & Bennett, 1998). While Defense and Minimization characteristics may not sound encouraging for culturally responsive practice, the DMIS identifies such characteristics as necessary processes to achieving the differentiated and complex understanding associated with Adaptation and Integration. Dave’s perceived similarities facilitated a deeper understanding of socioeconomic differences and increased intercultural experiences in a cyclical fashion. His perceived similarities with school site students fueled his cultural curiosity and guided his school site intercultural observations and interactions. In turn, the intercultural observations and interactions afforded Dave the opportunity to qualify some of his stereotypes about socioeconomic status.

Villegas and Lucas (2002) maintained that pre-service teachers relinquish deficit views when they no longer provide useful interpretations of differences. Some of Dave’s initial negative stereotypes became insufficient explanations for his observations. For instance, at an Open House, Dave observed students who were not congruent with his stereotypes of socioeconomic status and therefore had to qualify his stereotype. Qualifying stereotypes may set the stage for more elaborate and differentiated understandings of particular aspects of socioeconomic status. Dave also reported contradictory statements about upward mobility; however, he maintained that school site students would secure desirable employment in their respective trades even though he had no supporting data to support this assertion. This may reflect the pervasiveness of upward mobility and meritocracy of mainstream cultural norms (Hogan, 2007) and be more resistant to change than other stereotypes.

Overall, Dave exhibited characteristics suggesting at least some of his understandings of cultural differences were amenable to change. Garmon (2005) outlined dispositional factors associated with changing pre-service teachers’ attitudes toward diversity. Factors included openness, self-awareness, and “the willingness and ability to think critically about oneself” as influential factors (p. 276). Through self-awareness and self-reflection Dave appeared to progress toward Minimization. Before entering student teaching, Dave described experiencing privileges and constraints when discussing his social class status. On the one hand, for Dave, being middle class meant “I know I can do anything I want; whereas some people cannot afford it.” On the other hand, Dave also described feeling “limited” in his higher education institution choices due to monetary constraints. Feeling “limited” likely enabled Dave to identify similarities with his students while remembering his privilege prevented him from overgeneralizing these perceived similarities.

The small gains in Dave’s understanding of general cultural differences as measured by the IDI and interview data remind teacher educators that understanding culture is a complex, ongoing, and slow process. Hammer and Bennett’s (1998) assessment for Intercultural Sensitivity can indicate worldviews to plan for multicultural education (McAllister & Irvine, 2000; Van Hook, 2000). Gathering information about students’ understanding of cultural differences is one way to set realistic expectations for change. Recognizing positive and negative stereotypes as part of a larger change process may enable teacher educators to listen for qualitative changes in stereotypes that reflect decreased ethnocentrism, keeping expectations for change realistic.

What propels changes in understanding? Dave drew on self-awareness, specifically identifying his privilege, recognition of diversity, and comparisons drawn between himself and his students. Teacher educators may consider these elements to assess and foster cultural competence. Self-reflection fosters the development of cultural understanding among pre-service teachers (Brown, 2004; Gay, 2001; Garmon, 2004; Johnson, 2002; Milner, 2003). Periodically reflecting on privilege and perceived similarities and differences with field placement students may be an inroad for unearthing and
eventually questioning stereotypes. Such an exercise is worthy of consideration for pre-service teachers engaged in a field experience with a diverse student body.

This study has several limitations. The pre-service teacher volunteered for the study and his reports and experiences may not represent similar cases, and the small number of participants associated with case study research design does not allow for generalizing results to a population. The interviews contain questions about cultural differences that seemed to spark reflection and thus could have heightened sensitivity to cultural differences, potentially influencing subsequent interview and IDI responses.

References


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ABSTRACT

The educational goals espoused by teachers of mathematics reflect a wide variety of teaching beliefs and practices. The successful construction of knowledge will likely depend upon the students’ ability to discover existing and meaningful relationships among concepts. It has been suggested that incorporating a historical dimension into the mathematics classroom might help students to achieve a rich and deep construction of mathematical concepts. Research indicates that although teachers accept the idea they are reluctant to put it into practice. The purpose of this paper is to identify those factors that affect teachers’ decisions regarding the inclusion of the history of mathematics in their curricula and to analyze their perspectives on the incorporation of history into the teaching of mathematics.

STATEMENT OF THE PROBLEM

The National Council of Teachers of Mathematics (NCTM), as part of its recommended vision for school mathematics stated, “Mathematics is one of the greatest cultural and intellectual achievements of humankind, and citizens should develop an appreciation and understanding of that achievement, including its aesthetic and even recreational aspects” (NCTM, 2000, p. 4). In addition to these aspects, NCTM emphasizes the importance of realizing mathematics as a “cultural bridge.” It is likely that there are many avenues through which one could mediate the importance of mathematics as a cultural and intellectual achievement. One such avenue is through the learning of the history of mathematics. Including the history of mathematics in the classroom allows for the co-construction of knowledge, with the teacher and student acting as architects.

In addition, the NCTM (1989) in the Curriculum & Evaluation Standards provides a set of recommended goals for the design of educational curriculum. One such goal is that of Learning to Value Mathematics:

Students should have numerous and varied experiences related to the cultural, historical, and scientific evolution of mathematics so that they can appreciate the role of mathematics in the development of our contemporary society and explore relationships among mathematics and the disciplines it serves: the physical and life sciences, the social sciences, and the humanities…It is the intent of this goal—learning to value mathematics—to focus attention on the need for student awareness of the interaction between mathematics and the historical situation from which it has developed and the impact that interaction has on our culture and our lives. (New Goals for Students section, para.4)

The message of the National Council of Teachers of Mathematics is clear. Mathematics, as a socially constructed science provides a rich and deep contextual story. Learning the history of mathematics enables the student to place mathematics within the larger cultural context. In order to fully understand the achievement involved in creating mathematical concepts and the relational value of those concepts to each other, one must be given an opportunity to explore the history of mathematics in conjunction with the learning of mathematics. Acknowledging that teachers are the primary facilitators of the introduction of the history of mathematics into the classroom, the NCTM announced the creation of a professional development scholarship emphasizing the History of Mathematics (NCTM, 2009). It is the goal of NCTM to:

provide financial support for completing credit-bearing course work in the history of mathematics, creating and field-testing appropriate classroom activities incorporating the history of mathematics, and preparing and delivering a professional development presentation related to the history of mathematics to colleagues. (NCTM, 2009)

The NCTM is not alone in recommending that the history of mathematics be included as part of instructional practice. The National Research Council (1989) commissioned members of the Mathematical Sciences Education Board, the Board on Mathematical Sciences, and the Committee on the Mathematical Sciences in 2000, to conduct a study of United States mathematics education from K through graduate study. The findings and recommendations were published as a report titled Everybody Counts: A Report to the Nation on the Future of Mathematics Education. In the Understanding Mathematics section, it was recommended that teachers “…learn the history of mathematics and its impact on society, for it is
only through history that teachers will come to know that mathematics changes and to see the differences between contemporary and ancient mathematics” (p. 64). Implicitly this suggests that in order for students to learn the history of mathematics, teachers must first become familiar with the history of mathematics.

The importance of teacher exposure to the history of mathematics is exemplified by the standards established by the National Council for Accreditation of Teacher Education (NCATE, 2003). NCATE drafted, in conjunction with the NCTM, a set of standards that guide teacher education programs in their curricula development. The Content Standards consist of:

1. Knowledge of Number and Operation
2. Knowledge of Different Perspectives on Algebra
3. Knowledge of Geometries
4. Knowledge of Calculus
5. Knowledge of Discrete Mathematics
6. Knowledge of Data Analysis, Statistics, and Probability
7. Knowledge of Measurement

Each of the Content Standards makes specific reference to the demonstration of “…knowledge of the historical development…” (pp. 4-7). Professional organizations have clearly situated themselves in a position that supports and recognizes the integral part that knowledge of the history of mathematics plays in instruction and learning.

The recommended inclusion of the history of mathematics is espoused by professional organizations as well as by scholars and researchers. Kline (1972) stated, “The roots of the present lie deep in the past and almost nothing in that past is irrelevant to the man who seeks to understand how the present came to be what it is” (p. x). In order to fully appreciate mathematics in the present, it is worthwhile to become knowledgeable of mathematics of the past. According to Kline, mathematics as it is currently presented to students may appear disjointed and polished. The history of mathematics allows students to develop a broad perspective of the work involved in creating mathematical discoveries. Students may come to terms with their difficulties in mathematics if they are aware that mathematicians experienced the same frustrations over many years.

Swetz (1994) suggested the use of the history of mathematics in the classroom humanizes the subject students are asked to study. According to Swetz, “The history of mathematics supplies human roots to the subject. It associates mathematics with people and their needs. It humanizes the subject and, in doing so, removes some of its mystique” (p. 1). It is possible that some view mathematics as a discipline defined by facts and numbers or as a science of symbols that exists separately from humans. Introducing students to the mathematicians’ personal lives and intellectual struggle would allow the students to see the human aspect of mathematics.

Swetz, Fauvel, Bekken, Johansson and Katz (1995) suggested that exposure to the history of mathematics at the high school level can have “…a profound effect! For it is at the secondary or high school level that students first experience the power of mathematics and begin to realize the wide scope of its application and possibilities” (p. 1). It is unlikely that one can surmise a direct correlation between the learning of the history of mathematics and student achievement; nevertheless, teachers’ perceptions of the history of mathematics, teachers’ content knowledge, and teachers’ conceptions of mathematics as a discipline might potentially influence students’ attitudes toward mathematics and their success in the field. Barbin et al. (2000) posited:

The conviction that the use of history improves the learning of mathematics rests on two assumptions about the process of learning. The more a student is interested in mathematics, the more work will be done; and, the more work that is done, the greater will be the resulting learning and understanding. (p. 69)

The conviction in the importance of the learning of the history of mathematics need not rest on the students’ shoulders. Ultimately, the achievement of the ideal scenario described by Barin et al. would begin with and depend upon the teacher and his/her perspective on the value of including the history of mathematics in the classroom.

Research into teachers’ perspectives on the inclusion of the history in the mathematics classroom is scarce. Empirical studies suggested that while professional development focusing on the history of mathematics may raise teachers’ awareness of the value or importance of the history of mathematics, it does not lead to the implementation of that history in the classroom. (Philippou & Christou, 1998; Siu, 2004; Smestad, 2009a; Stander, 1989). It is likely that if teachers express no interest in using the history of mathematics, they will not incorporate it into their classroom instruction. There exists a gap between what is espoused in the professional and scholarly arena regarding the benefits of learning the history of mathematics and teachers’ perceptions of the use of the history of mathematics. Until research explores and uncovers teachers’ perceptions pertaining to the use of the history of mathematics in the classroom, our information
regarding the benefits of teaching the history of mathematics will be lacking.

As the first strand, this paper presents the existing empirical research on the teachers’ conceptions of mathematics as a discipline. Past mathematical learning experience and the confidence a teacher holds in his/her own mathematical knowledge may play a role in a teacher’s conception of mathematics. This strand investigates those factors which may influence teachers’ conceptions of mathematics.

The second strand presents an analysis of the existing research on teachers’ perceptions of the history of mathematics in the classroom as well as discusses factors and limitations affecting the incorporation of the history of mathematics into the classroom. The underpinnings of this paper focus on teachers’ perspectives regarding the benefit of the inclusion of the history of mathematics in the classroom.

TEACHERS’ CONCEPTIONS OF MATHEMATICS AS A DISCIPLINE

TEACHERS’ PAST EXPERIENCE IN LEARNING MATHEMATICS

Individuals entering the teaching profession bring a multitude of experiences into the classroom. Experiences related to the teachers’ learning of mathematics can potentially influence their understanding of mathematics as a discipline as well as their teaching methodology. Hersh (1998) stated, “One’s conception of what mathematics is affects one’s conception of how it should be presented. One’s manner of presenting is an indication of what one believes to be most essential in it” (p. 13). Existing research (Ball, 1988; Cooney, Shealy & Arvold, 1998; Dutton, 1962; Furinghetti, 2007; Philippou & Christou, 1998) has indicated that teachers teach in the manner in which they were taught. Their beliefs toward mathematics are shaped by their experiences in learning mathematics.

Ball’s (1988) study was designed to elicit prospective elementary teachers’ beliefs about teaching and learning by designing a sequence of activities around the concept of permutations and placing the prospective elementary teachers in the position of learner, observer, and teacher. The sequence of activities spanned two weeks with four 1 ½ hour sessions. In addition to class activities, the unit provided additional out of class participation as well. Ball’s study included 3 phases in which the prospective teachers were asked to participate. First they assumed the role of learner, followed by the role of observer, and lastly, the role of teacher. In this role, the teachers were asked to engage with someone with whom they could investigate the concept of permutations.

Utilizing an interview format, Ball described the various responses teachers provided for each of the three phases. A major outcome of the study was teachers’ realization of the extent to which their past learning experiences had shaped their present perceptions of mathematics. The experience the teachers had in past learning experiences were exposed when they assumed the role of teachers in phase 3. Ball stated:

Consequently, what they have learned in elementary and high school math classes often comprises almost all of their subject matter preparation for teaching. Their feelings and opinions about math may thus affect their approach to learning to teach it, and ultimately the way they teach it. (p. 14)

Ball’s research did not indicate the number of participants and whether or not the trepidation on the part of the prospective elementary teachers may have been due, in part, to the short duration of the study. Permutations may have been a quite difficult concept for the elementary teacher to grasp in such a short period of time. Therefore, teaching based upon past learning experiences may be a function of lack of time and not solely of subject difficulty. It might be the case that teachers teach the way they were taught when lack of preparation time and subject difficulty overshadow innovative teaching style.

Researchers (Dutton, 1962; Philippou & Christou, 1998) have found that some teachers carry with them experiences from as far back as elementary school. As part of their study, Philippou and Christou investigated prospective primary teachers’ attitudes toward mathematics upon entering the University education program and how past experiences had shaped their attitudes. Participants were given the Dutton’s Attitude Scale, the Self-rating Scale, and Justification Scale (as cited in Philippou & Christou, 1998, p. 195) designed to measure general feelings about mathematics and a justification scale in which the participants were asked to identify potential explanations for their like or dislike of mathematics. In addition to the three surveys, the participants engaged in a semi-structured interview.

The study was carried out over a 3 year period and in 3 phases. The first phase was implemented prior to the students’ exposure to the education program. Participants entered phase two after completion of the first course in the program and entered phase three after completing the entire education program. The total number of participants for phase 1 was N = 162, for
The results of the Dutton survey in phase 1 revealed a disturbingly high number of teachers entering the program with negative attitudes. According to Philippou and Christou (1998), “At the entrance level 24% of the subjects stated plainly that they ‘detest mathematics and avoid using it at all times’, 28% declared ‘[they] had never liked mathematics’, and 14% reported that they ‘[had] always been afraid of mathematics’” (p. 196). Philippou and Christou (1998) indicated that interview results provide an in depth analysis into the negative results identified in the surveys. “It becomes clear that most of the subjects developed negative attitudes out of experiences at the high school…” (p. 202).

The above research supports the speculation that teachers’ past experiences shape their attitudes toward mathematics. Teachers, whose attitudes toward mathematics are formulated by negative learning experiences, may unknowingly bring negativity into the classroom and lesson design. If this is the case, the probability of those teachers extending themselves into the historical domain is slim. A teacher’s conception of mathematics is not formulated by a single factor of a negative learning experience but by several factors worth investigating.

**Teachers’ Confidence in Content Knowledge**

For the purposes of this paper, conception is defined as a process of forming or understanding ideas or abstractions or their symbols. Teachers’ conceptions of mathematics, as a discipline, are a function of the process they use to understand and formulate abstractions from mathematical symbols and concepts. Confidence in the ability to perform this process is likely affected by self-confidence in content knowledge. Attitudes, perceptions, and self-efficacy may play a significant role in teachers’ motivations to extend beyond the realm of a prescribed curriculum and into the historical dimension of mathematics. If teachers lack confidence in their understanding of mathematics as a discipline, they might be unwilling to explore the historical dimension of mathematics in the classroom.

Having a solid foundation of content knowledge and confidence in that foundation may be instrumental in a teacher’s ability to conceptualize and process abstract mathematical ideas as well as to effectively design teaching strategies that promote student understanding. Shulman (1986) described three categories of content knowledge:

1. Subject Matter Content Knowledge
2. Pedagogical content knowledge
3. Curricular knowledge (p. 9)

**Subject matter content knowledge** refers to the mental organization and amount of knowledge pertaining to the subject area. A teacher’s knowledge of mathematics as a discipline and how he/she has effectively mentally organized mathematical concepts is an example of subject matter content knowledge. As described by Shulman, examples of mental organization would be the taxonomy of learning theories of Gagné or Bloom. In addition to the amount and organization of knowledge, another characteristic of subject matter content knowledge is the teacher’s ability to extend beyond the knowledge of facts or concepts. How, and to what extent, a teacher stretches beyond the prescribed curriculum may be a function of the teacher’s subject matter content knowledge.

The Massachusetts Department of Elementary and Secondary Education (2009) highlights the importance of content knowledge by requiring teachers who are pursuing an Elementary Teacher’s license to take a separate mathematics subject matter test in addition to a general curriculum test. Of the 34 teachers who took the Elementary Mathematics subject test, 29.4% passed. The percentages for other licensure tests requiring mathematics is listed in Table 1 (See next page). (Caution is provided by the Department of Elementary and Secondary Education of drawing conclusions based upon small sample sizes.)

The overall results of the mathematics subject matter tests indicated that, regardless of the small sample size, prospective teachers of mathematics certainly have room for improvement where subject matter content knowledge is concerned.

The second category of content knowledge described by Shulman (1986) is **Pedagogical Content Knowledge**. It is this category of content knowledge that may be instrumental in a teacher’s receptivity to the inclusion of the history of mathematics in the classroom. Pedagogical Content Knowledge is posited to consist of knowledge necessary for teaching. In this category, Shulman included:

The most useful forms of representation of … ideas, the most powerful analogies, illustrations, examples, explanations, and demonstrations—in a word, the ways of representing and formulating the subject that make it comprehensible to others. (p. 9)

Pedagogical content knowledge involves understanding the abstractions of a concept, presenting the
abstracts using a multitude of teaching strategies and knowing that the teaching strategies have effectively allowed students to construct new knowledge. Pedagogical content knowledge may also involve knowledge of teaching strategies that facilitate learning or impede the process of learning. Incorporating a historical perspective into a teaching strategy is one method of expanding pedagogical content knowledge. Teachers who are well grounded in their pedagogical content knowledge may be more open to the idea of incorporating the history of mathematics in the classroom.

The last category of Content Knowledge described by Shulman (1986) is that of Curricular Knowledge. Understanding how subjects relate to each other within a discipline and the relational awareness of one discipline to another discipline is an essential component of Content Knowledge. If a teacher views mathematics as a series of unrelated concepts with no bearing to the abstractions of nature or to other disciplines, it is possible they will view the history of mathematics as irrelevant to the learning of mathematics overall.

TEACHERS’ CONCEPTIONS ON THE HISTORY OF MATHEMATICS

Teachers’ Beliefs in the Value of the History of Mathematics

The educational goals of the mathematics classroom encompass a wide variety of teaching beliefs and practices. The successful construction of knowledge will likely depend upon the students’ ability to discover existing and meaningful relationships amongst concepts. When successful, the student has developed a rich knowledge base of mathematical concepts where the interconnectedness of concepts plays a significant role in the construction of future knowledge. Learning the rich history and evolution of mathematics may help the student to view mathematics as a dynamic human endeavor. Like piecing together a jigsaw puzzle, learning the history of mathematics has the potential of allowing the student to piece concepts together, to develop an appreciation for the evolution of concepts, and view the big picture of mathematics and its contributors—past, present, and future.

While this is a noble precept in theory, classroom practice is quite a different story. The issues at hand concern teachers’ confidence in their own knowledge of mathematics and their perceptions of the benefits of including the history of mathematics in the classroom. It is likely that a teacher’s belief and confidence in his/her own mathematical knowledge combined with his/her perception of the benefits of including history in the mathematics classroom will play a significant factor in the incorporation of history as part of the instructional practice. A teacher’s view of him/herself as a mediator of mathematical learning and teaching may inform his/her method of instructional practice. According to Fasanelli et al. (2000), “…an attitude towards history of mathematics in mathematics education very much depends on a general viewpoint towards mathematics learning and mathematics teaching (p. 28). Teachers who use the history of mathematics in their classrooms and those who do not may have polar views of their confidence in mathematics and the role that the history of mathematics plays. Although there exists an abundance of anecdotal opinion (Fauvel, 1992; Siu, 2004) extolling the benefits of the history of mathematics, there is very little empirical research examining teachers’ perspectives of the benefits of the history of mathematics as part of instructional practice.

There is no shortage of empirical research analyzing teachers’ behaviors. As Thompson (1984) indicated, researching behavior is a common practice because behavior is overtly observable. But “…any attempt to

<table>
<thead>
<tr>
<th>Test Name</th>
<th>First Time Test Takers</th>
<th>Test Retakers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>% Passing</td>
</tr>
<tr>
<td>General Curriculum: Mathematics</td>
<td>364</td>
<td>50.3</td>
</tr>
<tr>
<td>Mathematics</td>
<td>91</td>
<td>71.4</td>
</tr>
<tr>
<td>Middle School Mathematics</td>
<td>98</td>
<td>67.3</td>
</tr>
<tr>
<td>Middle School Mathematics/Science</td>
<td>18</td>
<td>27.8</td>
</tr>
<tr>
<td>Elementary Mathematics</td>
<td>34</td>
<td>29.4</td>
</tr>
</tbody>
</table>

(Massachusetts Department of Elementary & Secondary Education, 2009)
improve the quality of mathematics teaching must begin with an understanding of the conceptions held by the teachers and how these are related to their instructional practice” (p. 106).

Ideally, the learning that takes place in the classroom is mediation between the teacher and the student. In order for the history of mathematics to be included in the curriculum, it would be necessary for teachers to believe that it benefits the learning process. A teacher’s enthusiasm and expertise will likely dictate whether or not the history of mathematics, a topic that falls outside the mandated curriculum, is included in the classroom. Cooney, Shealy, and Arnold (1998) posited, “… one will value ideas and people to the extent to which they are congruent with the person’s belief system” (p. 317).

Empirical studies have indicated that teacher beliefs, interests, and value in the history of mathematics increased when introduced to the history of mathematics. However, studies also indicated that teachers found no interest in using the history of mathematics within the mandated curriculum (Philippou & Christou, 1998; Schram, Wilcox, Lapan & Lanier, 1988; Siu, 2004; Smestad, 2009a; Stander, 1989). In addition, it may be the case that mathematics teachers perceive the knowledge of the history of mathematics as inconsequential to the role of teaching mathematics (NCRTL, 1991).

A study published by the National Center for Research on Teacher Learning (NCRTL, 1991) examined formal teacher education and teacher learning, specifically the impact of formal teacher education on teacher learning in the areas of writing and mathematics. For the purposes of this paper, all references are to the subject area of mathematics. Researchers of the study chose to examine teachers at different stages of development. The various stages were: Preservice which included those who intend to teach but are not yet in practice; Alternate Route - teachers in this group had experience in a related field but lacked formal preparation; Induction included graduates of a pre-service program, and In-service was comprised of teachers with various amounts of teaching experience.

Participants and college programs were selected using a purposive sampling strategy. Three forms of data collection methods were utilized. The first method was a Likert scale questionnaire investigating teachers' knowledge, attitudes, and beliefs about teaching, learning, and subject matter. A second data collection method consisted of an observation that provided documentation of actual teaching practices. A pre and post observation interview was administered in an effort to gain insight into observed teaching practices. An observation guide was designed to provide consistency in observational documentation. The researchers identified spontaneity of teachers’ instruction as a potential for introducing variability to pre and post observation. Lastly, the researchers presented participants with standardized hypothetical teaching situations. For the purpose of identifying ways in which teachers' knowledge, beliefs and attitudes influenced teaching decisions, participants were asked to respond via interview to questions based upon the hypothetical teaching situation.

Researchers of The National Center for Research on Teacher Learning (NCRTL) theorized that many different domains are incorporated into the act of teaching. The intent of the NCRTL study was to gain perspective into decisions of teaching that emanated from the theorized domains. Similar to Shulman’s (1986) theories of Content Knowledge categories, the NCRTL (1991) researchers posited that the act of teaching would be informed by several factors and domains. The following domains were conjectured to be influential in the act of teaching:

- Act of Teaching
  - Knowledge of subject matter
  - Knowledge of curriculum
  - Knowledge of the teacher’s role
  - Knowledge of pedagogy
  - Knowledge of learning
  - Knowledge of learners

Regarding the purposes of such a model, NCRTL researchers commented:

[T]his model recognizes that teaching situations are multidimensional and rarely governed by a single principle. Second, it recognizes that teachers will make instructional decisions, regardless of what knowledge or beliefs they have available to them; that is, if they know little about the curriculum but a lot about the learning, they will probably base their decision on their understanding of learning. (p. 14)

In the case of the history of mathematics, such a model may provide insight into teachers’ instructional decisions on the inclusion of the history of mathematics as an integral and/or important part of instructional practice.

The study was divided into two categories of samples. The first category was described by the researchers of NCRTL (1991) as “extensive samples” (p. 18). A questionnaire was constructed and mailed throughout the United States. Approximately 700 participants responded. The second category of samples was
described as “intensive samples” in which interviews and classroom observations were utilized to collect data. Approximately 160 teachers participated in the observation and interview modes of collecting data and thus were categorized under the “intensive sample.” The study was conducted over a period of 1-3 years, depending upon the stage of development of the teachers. Some teachers were followed for a period of 3 years, through their entire program, while others were observed or interviewed over a period of 1 year if currently teaching.

Table 2 presents the results of a questionnaire in which the participants were presented with “…a list of activities asking respondents to indicate how helpful each would be in learning to teach” (NCRTL, 1991, p. 69). For example, teachers were asked how helpful a knowledge of the history of mathematics would be in learning to teach. As evidenced by the results, very little value was placed upon the study of the history of mathematics as an aid in learning to teach. The researchers of NCRTL commented:

The history of mathematics attracts little interest across the board. Most interested are alternate route candidates (60 [sic] percent) who presumably have the strongest background in mathematics already. Experienced teachers reject such knowledge as relevant to teaching. Only 18 percent agree that it is valuable. (p. 70)

It is likely the respondents of this survey would rarely incorporate the history of mathematics into their lessons if they believed that knowledge of the history of mathematics was not relevant to the process of learning to teach mathematics. Assuming the act of teaching is multidimensional and that subject matter, pedagogy, and curriculum are dimensions of teaching, it will be necessary for mathematics teachers to view the history of mathematics as a relevant component of subject matter, curriculum, and pedagogy in order for it to play a role in the classroom.

Smestad's (2009a) small case study of 4 teachers investigated the question “What are mathematics teachers’ conceptions of history of mathematics and what are the backgrounds for these” (p. 2)? The study took place in Norway “over a period of several years” (p. 4) and participants were recruited from secondary (students age 13-16) and high schools (students age 16-19). According to Smestad, the history of mathematics has been a required component of the Norwegian mathematics curriculum since 1997. The backgrounds of the 4 teachers are identified in Table 3:

Questions probed the teachers’ own experience using the history of mathematics, perceptions of the history of mathematics in the classroom, as well as the where or how the teacher had come to learn the history of mathematics. According to Smestad, “Of these four teachers, three claim to be very interested in history of mathematics…” (p. 7). Evidence of the claim was based on Smestad's interviews.

The fact that the history of mathematics is a required component of the Norwegian curriculum raises an interesting question. Would the participants include the history of mathematics as part of instruction if it was not required? Smestad posed the question: “Should history of mathematics be in the curriculum” (p. 9)? Teacher 2, Teacher 3, and Teacher 4 indicated an interest in and appreciated the value of the history of mathematics regardless of the mandate. There were many problems of this study, which limit any inferences or conclusions. Perhaps a broader cross section of gender and a wider range of age, as well as number of participants would have helped to provide greater insight into Smestad's (2009a) study of mathematics teachers' conceptions and value of the history of mathematics.

### Table 2

**Prospective and Practicing Teachers’ Beliefs about Sources of Knowledge in Learning to Teach Mathematics**

<table>
<thead>
<tr>
<th>Stages of Teacher Development</th>
<th>Teaching Experience</th>
<th>Course on Teaching Math</th>
<th>School Curriculum</th>
<th>Review Basic Skills</th>
<th>Course on Math</th>
<th>Study History of Math and Mathematics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preservice</td>
<td>99% (N = 405)</td>
<td>96%</td>
<td>89%</td>
<td>84%</td>
<td>81%</td>
<td>33%</td>
</tr>
<tr>
<td>Alternate Route</td>
<td>100% (N = 35)</td>
<td>92%</td>
<td>91%</td>
<td>50%</td>
<td>57%</td>
<td>69%</td>
</tr>
<tr>
<td>Induction</td>
<td>96% (N = 53)</td>
<td>87%</td>
<td>85%</td>
<td>79%</td>
<td>62%</td>
<td>40%</td>
</tr>
<tr>
<td>Inservice</td>
<td>84% (N = 57)</td>
<td>88%</td>
<td>59%</td>
<td>51%</td>
<td>70%</td>
<td>18%</td>
</tr>
</tbody>
</table>

(NCRTL, 1991, p. 71)
Ultimately, the inclusion of the history of mathematics will not depend upon a mandate but a teacher's conviction that such an inclusion as part of instruction is an important component of students' construction of mathematical knowledge.

Siu's (2004) study attempted to investigate the value teachers place on the history of mathematics as well as their utilization of the history of mathematics in the classroom. The study polled 360 mathematics teachers from 41 schools. Siu received an 82% response rate with 45% of those responding having less than five years of teaching experience and 55% having five or more years of teaching experience.

The mathematics teachers were divided into two categories, those who had taken a course on the history of mathematics and those who had not (Siu, 2004). The teachers were given a Likert-scale survey in which they were asked to provide an index of value of the history of mathematics. A selection of 1 indicated the teachers placed little or no value on the history of mathematics and a selection of 5 indicated teachers placed a high value on the history of mathematics. In addition, Siu asked respondents to provide an index rating of the utilization of the history of mathematics in their classrooms. A selection of 1 indicated little or no use and a selection of 5 indicated a high level of use of the history of mathematics in the classroom. The results are provided in Table 4.

From the data in Table 4, it appears as though teachers who were familiar with the history of mathematics through coursework may have been more likely to value and use it in the classroom.

Table 5 provides an index comparison of those teachers who read about the history of mathematics and those who did not. Teachers who have read about and are thus familiar with the history of mathematics seem to be much more aware of the importance of utilizing it in the classroom than those who have not.

Lastly, Siu (2004) investigated the value and utilization of the history of mathematics for those teachers “…who have read about the use of history of mathematics in teaching” (p. 3). Table 6 reveals the results of the index comparison between those teachers who kept abreast of issues concerning the teaching of the history of mathematics and those who did not.

According to Siu, “The conclusion to be drawn from these data is unmistakable. The value of history of mathematics is highly regarded by school teachers, but the degree of initiative on actually using history of mathematics in the classroom is very low” (p. 3).

A prominent result from Siu’s (2004) study was that the ratio of the use to the value of the history of mathematics appeared very low. This study prompts the question: “If teachers are interested in and value history of mathematics, why is there not more initiative to utilize it in the classroom”? It is quite possible that many factors impede the utilization of the history of mathematics in the classroom. One such factor might be the...
teaching - Teacher's Value and Utilization of the History of Mathematics

<table>
<thead>
<tr>
<th></th>
<th>Teachers who have read about the use of history of mathematics in teaching (25.0%)</th>
<th>Teachers who have NOT read about the use of history of mathematics in teaching (75.0%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of the History of Mathematics</td>
<td>4.07</td>
<td>3.73</td>
</tr>
<tr>
<td>Utilization of the History of Mathematics</td>
<td>1.78</td>
<td>1.37</td>
</tr>
</tbody>
</table>

(Siu, 2004, p. 3) 1=little value or use 5=high value or use

teachers' uncertainty of the benefits to the students and themselves when the history of mathematics is incorporated into the classroom.

**Will There Be Benefits to My Students?**

High school students' perception of mathematics and the methods by which they construct their mathematical knowledge may be improved by learning the history of mathematics. The history of mathematics can provide those students, who view mathematics as a collection of discrete facts and algorithms, with a conceptual foundation that builds a relationship between ideas, concepts, and definitions. Students' perceptions of mathematics as a discipline may be central to the questionable benefits of the history of mathematics in the classroom. Fauvel (1992) stated:

What is fundamentally at issue may be a deep cleavage between different ways of looking at mathematics. A mathematics which consists of timeless truths and value-free facts may be fundamentally inconsistent with one which develops through human endeavour [sic] within social contexts. (p. 3)

Students who view mathematics as value-free facts with no knowledge of the humanistic participation in the historical development of concepts may have a different attitude toward mathematics than those students who have a humanistic historical attachment to their construction of knowledge. The history of mathematics can provide clarity and insight into the “who”, “when”, and “whys” of mathematics. There is a distinct difference between learning to use the Pythagorean Theorem and learning why we use the Pythagorean Theorem. What was it, so many years ago, that necessitated the development of the Pythagorean Theorem? Who was Pythagoras? For the innumerable times a student writes the number zero, is he/she aware that zero was invented (Merick, 1998, p. 49)? What necessitated the need for a symbol that represents “nothing”? Is there an appreciation for the mathematical leap the invention of zero allowed? What was the earliest use of zero? By whom was zero invented? Providing students with a historical development of mathematics humanizes mathematics. Many researchers (Fauvel, 1992; Furinghetti, 1997; Siu, 2004; Smestad, 2009b) believe the history of mathematics provides students with the opportunity to construct a personal, visual, and emotional connection to the development of concepts. The humanizing benefit of the history of mathematics strikes a chord with the affective domain of learning. Students may find solace in learning of the difficulties or years of trials and tribulations Descartes faced when dealing with negative numbers. Calculus, which is neatly presented and developed in texts today, created centuries of struggle for mathematicians. When students encounter difficulty with the concept of the square root of a negative number, are they aware that difficulty with this concept dates as far back as 850 A.D. (Hellmich, 1998, p. 291)? Jones (1969) asserted, “…these stories offer the consolation that great men once had difficulties with what today are fairly well-clarified concepts” (p. 3).

Empirical research investigating the effects of the integration of the history of mathematics into the classroom is scant. One such study by Stander (1989) involved secondary students, twenty-two girls from a private school and forty-one boys from a comprehensive school. Each group was divided into two where the control group was presented with the mathematics of the Euler formula \((V - E + F = 2)\), which describes the relationship between faces, vertices, and edges of a convex polygon.

The experimental group was presented with the history of Euler, as well as with proofs and discovery of the Euler relationship \((V - E + F = 2)\). Stander (1989) issued a twenty item attitude Likert scale questionnaire before and after a two week experiment. Stander's research results indicated no change in students' attitudes toward mathematics either in the private or the comprehensive school even after their exposure to the history of mathematics. A limitation, as indicated by Stander, was the two week short span of time. According to Stander, “This experiment clearly showed that a limited short-term inclusion of some history of mathematics material had no effect on pupil attitudes towards mathematics” (p. 244).

Weng Kin's (2008) research measured the effect of the history of mathematics on students' attitudes toward Linear Algebra. Weng Kin's study focused on potential changes in beliefs, interest, confidence and persever-
ance of students when introduced to Linear Algebra from a historical perspective.

Weng Kin (2008) exposed 17 students to “minor inclusions” of history of Linear Algebra for the first six weeks of class. “Minor inclusions”, according to Weng Kin, involved the introduction of “historical snippets” (p. 18) rather than full immersion of historical connections to major concepts within the mathematical domain of Linear Algebra. The subsequent six weeks involved a major inclusion of history. Direct historical ties to Linear Algebra concepts were discussed in conjunction with the learning of new concepts. For example, Weng Kin (2008) utilized the historical element of Ancient Chinese Rod Numerals when introducing the concept of Gaussian elimination (p. 19).

The control group of 57 students was not exposed to any history. A Likert scale survey of sixteen questions was issued to both groups. Questions were categorized by beliefs, interests, confidence, and perseverance (Weng Kin, 2008).

Weng Kin’s (2008) research results suggested that the historical approach to teaching mathematics made a significant difference in increasing a students’ belief in the usefulness of mathematics as well as in their desire to persevere in mathematics. It appeared to have no significant difference in a student’s confidence toward or interest in mathematics. Weng Kin’s caveat in drawing a conclusion was the small sample size of the treatment group N = 17 and control group N = 57. Perhaps time allotted for inclusion of the history of mathematics played a role in changing a student’s attitude toward mathematics. Where Stander (1989) saw no change in two weeks, it appears that Weng Kin’s twelve week study produced some significant changes.

Lit, Siu and Wong’s (as cited in Siu, 2004) study on the use of the history of mathematics in the classroom examined two 8th grade classes of approximately 42 students in each grade. Based on examination results, the two classes consisted of “low achievers” and “more able-learners” (p. 3). The Pythagorean Theorem from a historical perspective was the focus of materials utilized in the classroom. Lit, Siu, and Wong’s (as cited in Siu, 2004) study investigated the change in students’ attitudes over the course of the Pythagorean Theorem lesson. The length of the study was not specified. Lit, Siu, and Wong found “The ‘more able learners’ in general dismiss history of mathematics as useless and time-wasting, while ‘lower achievers’ in general are more drawn to it” (p. 4). Siu provided anecdotal analysis that Hong Kong’s schools focus on calculation techniques by the Hong Kong Ministry of Education could implicitly relay to the ‘more able learners’ that foundational and historical building of mathematical concepts is not a high priority.

There were limitations for each study. For Stander (1989) it was the short time span of the study, for Weng Kin (2008) it was the small sample size whereas Siu (2004) did not specify the time span of the study. Therefore, it is difficult to make a conjecture one way or the other as to the benefits to the students of the history of mathematics as part of instructional practice.

Teachers’ conceptions of the history of mathematics may be flavored not only by the perception of the benefit to students but the benefit to the teachers themselves.

**How Will I, as a Teacher Benefit?**

From a pedagogical standpoint the inclusion of the history of mathematics may provide an opportunity for teachers to enrich their knowledge base as well as develop a varied repertoire of topics tangent to concepts prescribed by the curriculum. Barbin et al. (2000) posited:

The two most commonly presented reasons for the inclusion of a historical dimension are that history of mathematics provides an opportunity for developing our view of what mathematics is; and that it allows us to have a better understanding of concepts and theories. (p. 63)

Furinghetti (2004) viewed the history of mathematics “…as an artifact, which may be introduced in the classroom as a mediator in the process of teaching/learning” (p. 3). There has been the opinion (Fauvel, 1992; Katz, 1997; Swetz, 1982; Weng Kin, 2008) that teachers who teach mathematics from a historical dimension enrich their own knowledge base, which in turn allows their students to develop mathematical knowledge with a deep understanding of the breadth of concepts.

Mathematics is a dynamic science that has been in a state of flux for centuries. Those responsible for the invention of mathematical concepts endured rigor and conflict for years in order to refine mathematical concepts to their current presentation. If the process of rigor and conflict is not mentioned in classroom discussions, teachers as well as students may come to believe that mathematical concepts were easily conceived as they appear in texts today. For today’s mathematical students, it may take years to understand a mathematical concept but for the developer, it may have taken centuries. Teachers who understand the significance, laborious efforts, and time span of the developmental of the history of mathematics may take to their classroom
empathy for those students who have difficulty understanding concepts in the day or two allowed by the calendar school year. Barbin et al. (2004) speculated, “Historical and epistemological analysis helps the teacher to understand why a certain concept is difficult for the student and can help also in the teaching strategy and development” (p.64).

A teacher's enthusiasm and confidence in mathematics has the potential of supporting the claimed benefits of the history of mathematics in the classroom. One of the underpinnings of existing research posited by Schubring et al. (2000) that “…mathematics teachers' professional identity is their own intrinsic relation to their subject, their 'love of mathematics' ” (p. 128) clearly implies that a teacher's appreciation, interest, or confidence in the knowledge base for his/her subject will spark students' interest and appreciation in the subject as well. Current research has suggested that for those teachers whose education in mathematics includes a history of mathematics course, their interest, attitudes, and perception toward mathematics changes for the better (Furinghetti, 2007; Ismael, 2000; Lingard, 2000; Philippou & Christou, 1998; Siu, 2004; Weng Kin, 2008). If the studies of Lit, Siu, and Wong (as cited in Siu, 2004) and Weng Kin (2008) have suggested positive changes in the students' attitude, then the question we need to ask is why the history of mathematics does not play a more prominent role in the mathematics curriculum. As cited by Schubring et al. (2000), “A survey carried out by Victor Katz (1998) shows that in the majority of the United States certification requirements for teachers at secondary schools require the study of a course in the history of mathematics…” (p. 105). Given that the majority of teachers at secondary schools have had a course in the history of mathematics; one can conclude that there should be no shortage of mathematics teachers with knowledge in the history of math. Perhaps there is another factor that is getting in the way of delivery of the historical dimension of mathematics.

**Potential Limitations of Including the History of Mathematics in the Classroom**

It is likely that teachers are frequently encouraged by administration, education reform or parents to try new pedagogical theories. The scope and extent to which a teacher will incorporate new theories or practices depends largely on his/her belief that the change will have positive results. Time is a precious commodity for many teachers. With State mandated tests looming over teachers' shoulders, many teachers might have to weigh several factors when making the decision regarding pedagogical theories to introduce into their classrooms.

Cooney, Shealy, and Arvold (1998) cited several factors that come into play.

Some teachers may prefer to walk into a classroom with a prescribed outline of the required curriculum. A by-product of a mandated curriculum may be comfort and confidence in knowledge of the content. The role of authority will play a significant role in the teacher's willingness to expand or change the “scripted” curriculum.

A valid concern and factor is the need for evidence in order to integrate change. There is very little long term or substantial empirical research that clearly identifies the benefits to students and teachers of incorporating the history of mathematics into the classroom. So while it may make sense intuitively that learning the history of mathematics is beneficial, teachers need much more empirical evidence to exert the extra effort needed to make the necessary changes.

Cooney, Shealy, and Arvold (1988) also discussed von Glasersfeld's concept of reflection as a key determinant for teachers' willingness to change their beliefs or mode of instruction. Cooney, Shealy, and Arvold stated, “…reflection is directly connected with abstraction and re-presentation, which von Glasersfeld believed guide the ways we think and act” (p. 308). Incorporating the history of mathematics is no small task and calls upon the teacher to incorporate a standard of abstracting and re-presenting mathematical concepts. For the teacher to consider the history of mathematics as part of instructional practice there needs to be sufficient time for the teacher to reflect, discuss, and re-present his/her curriculum presentations. It is fair to say that this will not happen overnight.

Lastly, the underpinning of any attempt at pedagogical change is the teacher's belief system (Cooney, Shealy & Arvold, 1988). It is likely that a teacher's belief system will supersede empirical evidence as well as the voice of authority. If a teacher strongly believes that the inclusion of a historical dimension will not change students' attitudes or mathematical knowledge base, the teacher will likely not include it in his/her instructional practice, regardless of presented evidence. The extent to which a teacher embraces change will, with good probability, correlate with the teacher's beliefs regarding the suggested pedagogical change. At the risk of being repetitive, “…one will value ideas and people to the extent to which they are congruent with the person's belief system” (Cooney, Shealy & Arvold, 1988, p. 317). One cannot stress this enough.

This author conducted a small pilot study investigating teachers' perspectives on incorporating the history of mathematics into instructional practice. Sources for the survey questions were based upon the work of
to incorporate types of history. The perspective. Research has concluded that while there is some benefits of learning mathematics from a historical and its development to incorporate history, it may never happen.

Teachers’ perspectives on incorporating the history of mathematics seemed to correlate favorably with those who took a course in the history of mathematics. This is a good sign that there is a willingness to incorporate the history of mathematics as part of instructional practice for students who have taken a history of mathematics course.

According to this author’s pilot study survey, teachers who had not taken a history of mathematics course felt much less confident in their abilities to incorporate it into the classroom. Two respondents believed there was not enough time in a classroom period to incorporate the history of mathematics. Of the two respondents, one had 0 -1 years experience. It should be noted this pilot study makes no attempt to draw conclusions due to the small sample size. However, future questions for research may investigate whether a generalization exists between teacher background variables and the utilization of the history of mathematics in the classroom.

An interesting finding of this author’s survey was that none of the teachers pointed to the student as a reason for not including the history of mathematics. There was no indication of presumption that students would not like the history of mathematics. It appeared as though the teachers accepted full responsibility for the lack of incorporation. This strengthens the hypothesis that the keystone of the incorporation of the history of mathematics in the classroom is the teachers’ perspectives on the value of incorporating the history of mathematics in the classroom. If teachers do not see the benefit for themselves and the students, or if they lack time to incorporate history, it may never happen.

CONCLUSIONS AND RECOMMENDATIONS

If you would understand anything, observe its beginning and its development

Aristotle

The above literature review suggests that there are some benefits of learning mathematics from a historical perspective. Research has concluded that while there is not significant change in student cognition, there is a change in the students’ affective domain (Siu, 2004). In addition, research shows that teachers enjoy learning about the history of mathematics. However, the reality is that teachers are choosing to not utilize it outside of the mandated curriculum (Philippou & Christou, 1998; Schram, Wilcox, Lapan & Lanier; 1988; Siu, 2004).

This author asserts that the foundational justification for studying history in general is the same for studying the history of mathematics. Mathematics has played an integral role in the development of society and culture. Sarton (1957) stated, “…the history of mathematics should really be the kernel of the history of culture” (p. 4). Understanding and appreciating cultural achievements requires the inclusion of the history of mathematics as part of the understanding and appreciation of our culture, for it is through the advancement of mathematics that our global society has progressed economically, socially and scientifically.

In his article Why Study History? Stearns’s (1998) proposed that knowledge of history provides a perspective on events and factors that affect social change. The study of history is the study of human experience and evolution. Stearns contends the study of history develops the skill of assessment and judgment. It is Stearns contention that, “Learning history means gaining some skill in sorting through diverse, often conflicting interpretations” (p. 3). Being able to assess conflicting information as well as “past examples of change” are valuable by-products in the study of history.

Understanding the human experience that brought about change in the discipline of mathematics as well as acquiring the ability to assess conflicting ideas and concepts in mathematics may be, by parallel reasoning, a by-product in the study of the history of mathematics. Knowledge in the history of mathematics provides for an understanding of the humanistic endeavor, past and present, necessary to the creation of mathematics. If we are to understand the present and project into the future, we must be knowledgeable of the past. Concerning the importance of the study of history in the classroom, Gagnon (1988) stated, “By ignoring the reality of change from the past, it ignores as well the change there will surely be after us…” (p. 46). This is likely the case for the study of all types of history. The importance of learning the history of mathematics parallels that of learning history in general.

For there to be credence given to the potential benefits of learning mathematics from a historical perspective, there must be greater insight into teachers’ perspectives of including the history of mathematics as part of instructional practice. Incorporating history into
mathematics teaching and learning need not take a large amount of time and one does not have to be an expert in mathematical history. The history of mathematics can be introduced to students via historical snippets contextualized in the mathematical content to be introduced, or through historical biographies of the mathematician predominantly involved in the content discussion of the day. Teachers may be overestimating the time allotment and required knowledge needed to introduce the history of mathematics. Gaining insight into what teachers believe regarding the history of mathematics allows conceptions to be clarified and misconceptions to be eradicated through the learning of history of math. Possible questions for future research might include:

• What are High School mathematics teacher’s conceptions of Mathematics as a discipline?
• What are High School mathematics teacher’s conceptions of the history of mathematics?
• What are High School mathematics teacher’s perceptions of the inclusion of the history of mathematics in the classroom?
• Is there a relationship between teacher background variables and the choice to include the history of mathematics as part of classroom instruction?

References


INTRODUCTION

The scientific method is associated with a series of steps that people assume scientists use when doing science. The number of steps, of course, varies depending on the source. Karl Pearson (1949), in his book The Grammar of Science which was first published in 1892, identified what he believed to be the three features of the scientific method (p. 37). Prof. Frank Wolfs (2008), on his homepage for his physics students, at the University of Rochester in New York, outlined four steps. Norman Edmund (2005), in his report to the U. S. Department of Education, Institute of Education Sciences, and various other bodies, outlined eleven steps to this method (p. 15). Regardless of the number of steps, the common idea appears to be that the method involves an observation of a phenomenon leading to the generation of questions that result in the synthesis of a hypothesis enabling the observer to make predictions and test these predictions. Then through this testing, data or evidence is collected and analyzed to see if the hypothesis could be supported; if it can, then a valid conclusion is reached.

Although this method is embraced by many members of the scientific and non-scientific community, and taught to students in schools and colleges around the world, there are a group of people, including renowned scientists, whose beliefs question the existence of a scientific method. This certainly was the case with this investigation of the scientific method. When one generally accepts without question the existence of the scientific method, it comes as a surprise to learn of certain individuals adamantly vocalizing that it does not exist (Conant, 1964). Moreover, it is even more astounding to hear that science should not be practiced under a strict method, but be conducted as if anything goes (Feyerabend, 1976); or that there is no single method which scientist use for they work in a series of paradigms (Kuhn, 1970).

This observation generated many questions, and to seek answers to all these questions would be beyond the scope of this investigation. So one question was selected to focus on—what are the notions behind these opposing beliefs? In searching for an answer to this question, it seemed appropriate to, first investigate the origin of the scientific method, and describe its benefits.

RESULTS OF THE INVESTIGATION

A scientific investigation is indeed a complex process, but the main aim is for a scientist to obtain unbiased data or evidence to answer the questions posed and explain their observations. The origin of the scientific method was traced in an attempt to understand whether it was discovered or invented, and its benefits were explored to demonstrate that it is a necessary requirement in the practice of science.

ORIGIN OF THE SCIENTIFIC METHOD

One cannot say with any certainty as to where the scientific method actually comes from. Depending on the source, there are discrepancies as to who first introduced the scientific method or used it, the Greeks or the...
Arabs? In majority of the literature, the credit goes to Aristotle as the first to introduce the scientific method. He was, according to these sources, the first to introduce the dual path of scientific reasoning by implying that universal truths can first be known via induction; and then through deductive reasoning (in the form of syllogism) causes can be identified and scientific knowledge acquired (Wikipedia, 2009). However, the first experimental scientific method, apparently, may be associated with the work of Arabs who used a combination of observations, experiments, rational arguments, as well as repeat experiments. As with the Greeks, the Arabic scientists were concerned about the isolation of the truth. Even then, there were disputations as to the most rational way of arriving at this truth. Some believed that a question should lead to an experiment and others such as al-Biruni, a leading figure in Islamic science during the 11th century, supposedly have said that “universals [should] came out of practical, experimental work” and “theories [should be] formulated after discoveries” (Sardar, 1998).

Centuries later, inspired by the writings of these Arabic scientists and Aristotle’s idea of induction, Roger Bacon, may have described his own “repeating cycle of observation, hypothesis, experimentation, and the need for independent verification” (Wikipedia, 2009). However, it was Galileo that is unanimously acclaimed to have practiced and pioneered the scientific method. His method, according to Kline (1985) consisted of first “seeking” quantitative descriptions of physical phenomena, second “isolate[ing] and measure[ing] the most fundamental properties of the phenomena”, the “build[ing] up science deductively on the basis of fundamental physical principles” and finally “idealiz[ing]” (p. 103). It, therefore, seems only appropriate to give Galileo the credit for his genius, imagination and wisdom, and showing selectivity in what he chose to study in depth; as he certainly “showed the restraint of the master” (p. 103) thus “enable[ing] humanity to uncover the behavior of many natural phenomena that might otherwise have remained unknown” (p. 106).

Following on from Galileo, two other important figures are associated with the contribution to the idea of the existence of the scientific method during the 17th century. They were Francis Bacon and Rene Descartes. The former, suggested that a scientist should be an impartial viewer of nature collecting observations without any preconceptions and after making these observations, any patterns emerging would give rise to the truths about nature (Goodstein, 2000). Hypothesizing, in Bacon’s method, apparently played a very insignificant role, perhaps expecting it to transpire during the investigation (Wikipedia, 2009). Descartes, on the other hand, produced a four part method which can be summarized as first “accepting as ‘truth’ only clear, distinct ideas that could not be doubted”; second “breaking a problem down into parts”; third “deducing one conclusion from another;” and finally “conducting a systematic synthesis of all things” (Nordgren, 1998). Thus, Descartes approach was a deductive model of reasoning, whereas the Baconian model was inductive observation. Though both these men differed in their approach to scientific reasoning, it is clear that they were concerned about providing a firm foundation for scientific thought by eradicating bias and avoiding deceptions of the mind and senses in scientific investigations (Nordgren, 1998; Wikipedia, 2009).

It is possible that debates over the detailed nature of the method involving inductive to deductive reasoning to have continued throughout the 17th and 18th centuries. Nevertheless, despite these debates the scientific method, apparently, became an important tool for distinguishing between “scientific” and “non-scientific” approaches to describing the natural world (Schuster & Yeo, 1987, p. ix). By the 19th century, the scientific community appeared to have accepted the existence of the scientific method that made “natural science the most secure form of knowledge” (p. ix). Then in the early part of the 20th century, disciplines in the area of social sciences were also using the method of the natural scientists to justify their claims (pp. ix–x). The scientific method was thus believed to be the “epitome of reason and portrayed as an instrument capable of producing objective knowledge wherever it is properly applied” (p. x).

**BENEFITS OF THE SCIENTIFIC METHOD**

There are probably many benefits to the scientific method. Described below are two of the benefits that indicate the necessity of the scientific method. The first is that it allows people to make judgments between science and pseudo science. Gower (1996) commented that people have confidence in claims described scientifically because they have confidence that scientific claims are reliable. The basis of this confidence was found to have its roots in the authority of science; people trust these claims because they are scientific therefore they are authoritative (p. 6). Why do people simply accept the authoritative nature of science? The answer to this question is not that simple. One reason, perhaps, is the trust that people have in the scientific method. Simply because it has been “identified with the highest standards of intellectual rigor and the most reliable proce-
dures for gaining and assessing knowledge”; other forms of inquiry not based on this method are considered to be unreliable and not trustworthy as they may have been manipulated by “passion, subjectivity, prejudice, political bias, and socio-economic interest” (Schuster & Yeo, 1987, p. x).

Secondly, it is quite possible that a scientist who understands and practices the techniques of the scientific method would be more productive in his or her field, as they, it s believed, will show greater adaptability, greater interest, and more realism to judge the science’s powers and limits (Gauch, 2003). In addition, they are also better researchers because “they make better decisions about whether or not to question an earlier interpretation of their data as a result of new evidence” and “whether or not there is a need to repeat an experiment . . . , and how certain or accurate their conclusions are” (p. 9). If this was taken to be a benefit of the scientific method to the scientist, then it can be said that an inadequate understanding of the principles of this method can retard progress to the same extent as “inappropriate laboratory equipment or inadequate training” (pp. 7-8).

ANALYSIS

In science, analysis involves breaking down results from a scientific investigation into smaller parts to gain a better understanding of them. This investigation of the scientific method discovered that the existence of a single method came into conflict, only in the latter half of the 20th century. This analysis aims to present the notion behind this challenge by considering two of the leading figures in science during that time: James Conant, and Paul Feyerabend.

“ALLEGED SCIENTIFIC METHOD.”

James Conant (1964) in his book Science and Common Sense referred to the scientific method as the “alleged scientific method”, the reason for this is because he repudiates the existence of the this method by announcing that “there is no such thing as the scientific method” (p. 45). In analyzing the notion behind this claim it was important to first establish a probable reason as to why he believes other people acknowledge the existence of the scientific method and secondly, to uncover his perceptions of science and scientists.

Conant (1964) criticizes the survival of the scientific method through the years because of its association with impartial and rational enquiry (p. 7). He argues that this attitude towards obtaining exact and impartial facts did not come through an invention by those involved in scientific inquiry, as they did not consider it important (p. 8). He asserts that scientists gradually imposed self-discipline upon themselves because historically most of these scientists were amateurs and their work was easily contradicted rather than supported (p. 8) Then as the generations that followed saw how their predecessors meticulously proved their work and avoided barriers to their progress, the “standards of exactness and impartiality was gradually raised” (p. 9).

Conant reasons that it really is misleading to say, “all impartial and accurate analyses of facts are examples of the scientific method” as this would only “add confusion … to the problems of understanding science” (p. 14). He believes that it is possible to obtain an exact and an impartial analysis of facts in science without a scientific method, as the scientist’s mind will be conditioned to making such analysis when he or she is exposed to the discipline (p. 8), i.e. trained as a scientist. Further, he does not think that people should view scientists with high esteem simply because they are impartial enquirers, as this attitude should be inherent in everyone (pp. 13-14).

With regard to Conant’s (1964) perception of science and scientists, he appears to be of the mindset that the works of scientists are difficult to comprehend by a layperson (p. 4). He disapproves of the way the scientific method simplifies a scientist’s work. As he supposes, that this oversimplification misleads the layperson into believing that discoveries in science occurs in a logical order (p. 44), and consequently people will not appreciate the “stumbling way” in which scientists arrive at their conclusions (p. 44). He comments that the scientific method would result in science viewed merely as a method, consisting of:

- asking a clear, answerable question in order to direct one’s observations which are made in a calm, unprejudiced manner, reported as accurately as possible and in such a way as to answer the questions that were asked to begin with; any assumptions that were held before the observations are now revised in the light of what happened (p. 50).

His concern thus appears to be that this step-wise scientific method makes a mockery of what scientists really do, for he says that if the scientific method was presented to a “group of discerning young people they may come back with the statement that they have been scientists all their lives!” (p. 50).

Thus, Conant does not appear to be comfortable with the using of the scientific method as a problem-
solving technique is that applicable to any practical situation (p. 42) by anyone, including young people, who are not scientists (p. 50). He may well have wanted scientific work to be a separate entity from everyday situations, as he keeps emphasizing the difficulty of scientific research, and he may have had high regard for what scientists did. Science for him was a dynamic process that a scientist carried out in a laboratory, and only in laboratories: “science would disappear completely if all the laboratories were closed” (p. 25). Therefore, to have a method that anyone could use anywhere and at anytime was not the vision that Conant had of scientific research, so he rejects the existence of the scientific method.

“ANYTHING GOES.”

Paul Feyerabend (1975) is also concerned about the simplification of science, but his argument appears to be for complete eradication of any sort of method. By referring to human history to make his point about getting rid of the scientific method, he quotes from a publication by Herbert Butterfield that infers that history has no uniformity and is full of unpredictable events and characters (p. 17), and Feyerabend questions, if any methodology can explain these events. It is quite possible that, at this stage, he is comparing human historical events to historical scientific events (which have been reported in literature to have adhered to a method), and scientists to those unpredictable historical characters. This is evident from his comment, that those who succeeded were “ruthless opportunist[s]” who were not tied to any particular philosophy and who adopt[ed] whatever procedure” that fit the situation (p. 18). Feyerabend's position is that scientific method is too constrained and it inhibits progress and “anything goes” is the only solution (p.23), and anarchism is more appropriate for the philosophy of science (p. 17).

In his book Against Method, Feyerabend (1975) provides case studies to support his position that one should put aside methodology and conduct scientific research in a different way to see what happens (p. 296). He generalizes that every rule at some point in history has been violated and these violations occur not because of an accident, or lack of knowledge, but because it was necessary for progress (p. 23). In support of his argument regarding the boundaries exhibited by methodological rules he used examples from the history of science that showed progress (e.g. Copernican revolution) where thinkers, he says, “either decided not to be bound” by these rules or because “they unwittingly broke them” (p. 23).

Although Feyerabend (1975) may have carefully thought out his arguments for his case against the method, there are a number of opponents who argue that these cases are bad examples and Feyerabend’s thinking as absurd. As his case for abolishing the scientific method appears bizarre to a rational thinker, it is not that easy to understand whether his argument is actually against the scientific method or science itself. He appears to resent that results obtained by any other method are ruled out (p. 20) and declares that it is “necessary to re-examine our attitude towards myth, religion, magic,” and “witchcraft” (p. 298). He disputes that science “took over by force, not by argument” (p. 296), and scientific ideas, laws, and facts are not accepted democratically as they are not subjected to a vote (p. 301). In addition, he comments that there is no separation between state and science, and that “an American can now choose the religion he likes, he is still not permitted to demand that his children learn magic rather than science at school” (p. 299).

So where do these notions come from? Perhaps he really believes that this is how it should be. However, in any analysis of experimental results, a scientist may not simply accept this as a reasonable conclusion. An explanation is always sought if not to convince others, but for personal satisfaction—to make sense of it all. In this case, a possible explanation to Feyerabend’s case against the scientific method may be due to personal experience as he may have had his belief system already embedded in the area referred to as pseudoscience. There are reports that he had received treatment for poor health from a healer, and “used to refer to his own case as an example of both the failures of orthodox medicine and the largely unexplored possibilities of ‘alternative’ or traditional remedies” (Stanford Encyclopedia of Philosophy, 2009).

THE ANOMALY

During the analysis of results in a scientific investigation, a scientist would sometimes stumble on an anomalous result that requires further in-depth investigation. This was the case with Thomas Kuhn’s (1970) idea of paradigms and scientific revolutions. Although many people may have understood his idea, there were diverse interpretations of his concept of paradigms and scientific revolutions. It was therefore difficult to analyze accurately where his notion came from. As a student of Conant, one could assume that he developed his ideas from his teacher, but Kuhn (1970) does not appear to claim that the scientific method does not exist.

His idea is that scientists work in communities with a set of beliefs (p. 4) which they had received through
their rigorous training which had become embedded in their minds, thus scientific research involves a “strenuous and devoted attempt to force nature into the conceptual boxes supplied by professional education” (p. 5). He uses the phrase ‘normal science’ as an “activity in which most scientists inevitably spend almost all their time” (p. 5) and therefore there is this assumption that the scientists working in this community know what the world is like and they will passionately defend this assumption (p. 5), this is what Kuhn refers to as a paradigm. However, there are issues with the practice of normal science. Occasionally scientists will be faced with an anomalous result or a concept that will “suppress fundamental novelties” (p. 5), threaten the normal belief—the established paradigm. As this may not prove easy to solve by the ablest mind or by the instrumentation at that time, they are put aside for a long period. Then a point comes when enough of these anomalies accumulate and the scientific community can no longer ignore these events. When this occurs, the paradigm shifts (p. 6) to adopt a new set of beliefs, methods, and assumptions that are radically different to the old beliefs—“the scientist’s world is qualitatively transformed as well as quantitatively enriched” (p. 7)—and this is what Kuhn may refer to as the scientific revolution (p. 6).

It is quite possible that Kuhn was suggesting that that instead of one particular teachable method, or a regimental set of rules that govern a community of scientists, it is this paradigm that guides the scientific thinking (Stinner, 2003). A possible interpretation of this then would mean that there is no one scientific method, but many depending on the paradigm the scientists are working in. Additionally if the paradigm shifts, then so would the methods.

**DISCUSSION**

This investigation of the scientific method resulted in the deviation of the accepted belief that the method is composed of steps which scientists follow when conducting experiments. These steps, as outlined in textbooks, make it clear that this is the procedure used by scientists to make discoveries. Perhaps this is a simplification of what scientists really do, and Conant (1964), Feyerabend (1976), and Kuhn (1970) had a point. This simplification is probably necessary to ensure basic scientific literacy and these textbooks only give the “finished scientific achievements” for “persuasive and pedagogic reasons” (Kuhn, 1970, p. 1). Nevertheless, it is probably the orderliness of the single method, which had the human appeal thus allowing the method to survive so long. Order, after all, makes more sense and is easier to perceive than disorder.

However, in viewing these steps differently, it is possible to see that each individual step that makes up the scientific method has its own staircase, and thus becomes a method in its own right. For example, when analyzing the results obtained, a scientist would follow a procedure to verify this data, a process of steps. Therefore, this would mean it is possible to regard inductive and deductive reasoning that makes up the scientific method as separate methods within the umbrella of the scientific method, as would the method of generating a hypothesis, obtaining evidence, and evaluating an experiment.

If this was the case, then it is reasonable to disagree with Conant’s (1964) belief that the scientific method does not exist. If it is the stepwise nature of the scientific method that he is disputing and its use for problem-solving in practical situations, then there is further need for not accepting his point. Many scientists and non-scientists regard the scientific method as a problem-solving method (Edmund, 2005). In fact, Huxley (1963) lectured that special training is not necessary to use the scientific method, because everyone uses the induction and deduction methods that scientists use to build hypotheses and theories all the time throughout life (pp. 2–3).

Scientific method has survived to the present day probably because a great majority of people accept it. So getting rid of it as Feyerabend suggests, may be the same as getting rid of a national treasure. As to his argument in favor of accepting results of investigations that have not adhered to a scientific method (Feyerabend, 1976, p. 20), one can only ask if there is any guarantee that these results would benefit life on this planet as authentic scientific results have. In considering this, the idea of the scientific method as a means for obtaining unbiased results becomes more prominent, and works of Descartes and Francis Bacon become more valuable.

Finally, with respect to Kuhn’s paradigms, there does not appear to be a case against the existence of the scientific method or abolishing it. His ideas are more profound, and he may well be suggesting explanations to scientific discoveries highlighting that there is more than one scientific method.

**CONCLUSION**

Whether there is a single scientific method with many steps that scientists follow or a paradigm, the conclusion is that scientific research does follow some sort of a process used by the practitioners of science when doing science. Moreover, this method, or even methods, is what scientists use to explain to both scientific and
non-scientific communities the inferences of research. Ultimately, what really matters is that the data is valid and reliable, and that the research conducted honestly, rigorously, and without bias.

References


ABSTRACT

Research suggests that social capital can provide opportunities, pathways, and social mobility as well as increase students’ self-efficacy, well-being, and resilience. This paper examines whether continuation high schools, an alternative education program in California, provide supports and opportunities that build bonding and bridging social capital for at-risk youth. A review of the growing body of literature on continuation high schools is provided along with insights gained from an interview with Dr. Richard Ashcroft, a professor from California State University San Bernardino and the author's experiences as a continuation high school teacher in San Francisco. The literature is examined for evidence of social capital in the forms of bonding and bridging. Research indicates that continuation schools that are viewed as “safety nets” do provide institutional supports that foster social capital whereas continuation schools that are viewed as “safety valves” provided few, if any, institutional supports. Recommendations and implications for future practice and research in this field are also provided.

The following paper will examine the literature on continuation high schools for evidence of supports and opportunities that build bonding and bridging social capital for at-risk youth. According to the California Department of Education (CDOE) website, at-risk youth can include students who have been expelled, suspended, retained, or who are habitually truant. They may also be pregnant and/or parenting youth, recovered dropouts, or wards of the state. Various alternative education programs exist in the state of California. They include independent study programs, community day schools, opportunity schools, county-operated court and community schools, and California Youth Authority (CYA) schools. In addition to these alternatives, California offers another form of alternative education called continuation high schools.

Continuation high schools offer credit recovery programs for students who are over the age of 16 years old and at-risk of not graduating. California had more than 71,000 students enrolled in 523 continuation high schools during the 2007–2008 school year. The 2009–2010 school year marks their 90th anniversary as a form of alternative education in California. In addition to academic courses, these alternative schools according to the CDOE (n.d.) provide guidance, career orientation, work-study schedules as well as supplemental programs such as independent study, career counseling, job placement, apprenticeships, and concurrent enrollment in community colleges.

RESEARCH ON CONTINUATION HIGH SCHOOLS

Despite the prevalence of continuation high schools throughout the state of California, a minimal amount of research exists that examines exclusively students who attend these schools. Moreover, most of the peer reviewed studies on continuation high school students found through the electronic databases of the University of Massachusetts Lowells libraries focus mainly on drug-related issues (Ames et al., 2007; de Moor et al., 1994; Pokhrel, Sussman, Rohrbach, & Sun, 2007; Skara, Sussman, & Dent, 2001; Sussman & Dent, 1999; Sussman & Dent, 2004; Sussman, Dent, & Stacy, 1996; Sussman, Rohrbach, Skara, & Dent, 2004; Sussman et al., 1997; Sussman, Skara, de Calice, Hoffman, & Dent, 2005; Sussman & Stacy, 1994; Sussman et al., 1995).

Nevertheless, there are some researchers who have studied topics other than drug use among this population. Loutzenheiser (2002) conducted an interview-based study on nine female continuation high school students in order to gain insight into why these students disconnected from schooling in regular schools but reconnected within a continuation high school. Kratzert and Kratzert (1991) attempted to identify characteristics of continuation high school students. Worrell (1996) examined the influence of protective factors on graduation rates among continuation high school students. Worrell and Hale (2001) studied whether hope in the future and school climate can serve as protective factors for continuation students. Two comparative studies have also been conducted. Both studies investigated the differences between regular education, special education, and continuation high school students; however, one focused on predictors of global self-worth and academic performance (Wiest, Wong, & Kriel, 1998) while the other looked at factors related to motivation (Wiest, Wong, Cervantes, Craik, & Kriel, 2001). In addition to the aforementioned studies, a legislative report (Warren, 2007), two issue briefs (Perez & Johnson, 2008; Ruiz de Velasco et al., 2008), and three technical reports (McLaughlin, Atukpawu, & Williamson, 2008; Ruiz de Velasco, 2008; Williamson, 2008) specifically focused on continuation high schools were released within the last two years.
CONTINUATION STUDENTS

These studies offer more detailed descriptions of the challenges faced by continuation high school students than the abovementioned California Department of Education’s definition. Most continuation high school students are usually behind in credits (Perez & Johnson, 2008; Ruiz de Velasco et al., 2008; Warren, 2007). They become behind in credits due to a variety of reasons such as chronic truancy or absenteeism, low academic skills, failing grades, or a lack of academic motivation. Truant students may miss school because they have to work to help support their families. They may also have to take care of younger siblings, parents, or their own children. These students may also have missed school because they are not engaged by the courses being offered or have experienced some form of trauma or illness that rendered them incapable of attending school for a period of time.

Continuation students have been called disengaged (Kelly, 1993), disinterested (Loutzenheiser, 2002), vulnerable (Ruiz de Velasco, 2008) and at-risk (Worrell & Hale, 2001). They view themselves as different from other students in the comprehensive high schools (Kratzert & Kratzert, 1991; Loutzenheiser, 2002). They are more likely to be students of color, English language learners, and students with disabilities as well as adolescents who live in foster or group homes and youth who suffer from mental illnesses or engage in substance abuse (Ruiz de Velasco, 2008). Some are victims of violence, drug abuse, racism, sexism, and incest (Loutzenheiser, 2002). They are also likely to be from poor neighborhoods and have less educated parents. Continuation high school students can also have very low reading skills (Perez & Johnson, 2008). This may be due to a lack of pre-school opportunities, learning disabilities, or gaps in learning due to absenteeism. These students may also lack appropriate adult role models and depend upon representatives from institutions such as foster care, the juvenile justice system, and child protective services to serve as their primary caretakers (Perez & Johnson, 2008).

CONTINUATION HIGH SCHOOLS: SAFETY NETS OR SAFETY VALVES?

In addition to aforesaid studies, a seminal work for continuation high schools entitled Last Chance High: How Girls and Boys Drop In and Out of Alternative Schools was published in 1993 by Deidre Kelly. This book details Kelly’s five-year longitudinal study on two continuation high schools in northern California. This work also provides a detailed history of continuation schools, a typology of the unspoken goals of schools and districts in relation to continuation high schools, the stigmatization that accompanies attending an alternative program, and explanations for student disengagement and reengagement.

In some respects, Kelly’s (1993) work is outdated because the study was conducted prior to the passing of No Child Left Behind and the California Public School Accountability Act (PSAA). Also, continuation high schools are now held to the same graduation requirement as the comprehensive high schools: a passing score on both sections of the California High School Exit Exam (CAHSEE). Nevertheless, current continuation high schools as well as other forms of alternative programs are still struggling with many of the issues presented within Kelly’s book (Warren, 2007).

Subsequent researchers in the field of alternative education (Loutzenheiser, 2002; Munoz, 2004/2005; Ruiz de Velasco, 2008; Warren, 2008) seem most influenced by Kelly’s (1993) typology of the perceptions of continuation high schools as either safety nets or safety valves. Continuation high schools that are viewed as safety nets typically focus on accommodating differences in students’ learning styles, abilities, interests, schedules, and future goals. Safety nets are also perceived as alternative educational centers that focus on fixing the school to meet “the intellectual and social needs of those that mainstream schools cannot or will not help, a program that meets with some measure of success in reengaging students” (Kelly, 1993, p. 68).

Conversely, when continuation high schools are viewed as safety valves they are typically seen as providing “a mechanism to rid mainstream schools of failures and misfits without holding school administrators fully accountable for the consequences, a mechanism that reinforces students’ disengagement from school” (Kelly, 1993, p. 68). Kelly further states that when continuation schools are perceived as safety valves, they are treated as dumping grounds for comprehensive schools who want to keep their student populations more “pure” by segregating “problem” students. Also this view tends to regard continuation high schools as treatment centers that need to fix or rehabilitate those that are pushed out of mainstream schooling. School administrators and counselors that view continuation schools as safety valves are more likely to use them as threats or scare tactics in order to keep students in line at the comprehensive high schools. This view stigmatizes, marginalizes, and subordinates continuation schools and their students.
METHODOLOGY

In order to gather studies for this paper, 13 databases were queried through the University of Massachusetts Lowell libraries. The key word continuation high school yielded 163 articles. These articles were then narrowed down using the scholarly (peer review) journal filter. This filter resulted in 51 non-repeating titles. The abstracts for these articles were reviewed. Then, a second filter was applied to these 51 articles in order to obtain a list of only those titles that were available in full text; the final result was 12 non-repeating titles. An Internet search was also conducted using the search engine google.com which yielded the six current reports and Kelly's (1993) book. Additional database and Internet searches using the key words alternative programs, alternative schools, and alternative education were conducted in hopes of finding additional continuation high school studies possibly listed under the umbrella of alternative education. The California Department of Education, California Continuation Education Association, and John W. Gardner Center's websites were also referenced frequently throughout the research process. The analysis also draws upon the author's experiences as a continuation teacher of Ida B. Wells High School in San Francisco and insights gathered from an interview with Dr. Richard Ashcroft, a professor from California State University San Bernardino, who has worked extensively in the field of alternative education.

SOCIAL CAPITAL

According Stanton-Salazar (2001), “Social capital is a set of properties existing within socially patterned associations among people that, when activated, enable them to accomplish their goals or to empower themselves in some meaningful way” (p. 265). He further states that these associations can take place at an individual level, a group level, or a community level. For example, an association at the individual level in a continuation high school could occur between an English teacher and a student whereas an association at a group level may happen among the parents of a continuation high school. Associations that can take place at the community level in reference to continuation students could be among groups such as teachers, social workers, probation officers, community leaders, and parents. Stanton-Salazar (2001) further states that social capital involves “reciprocal investments in a relationship or set of relations” (p. 265) that can “lead to trust as well as to enforceable expectations and obligations” (p. 266) and the generation of resources in the forms of “emotional, social, and institutional” support (p. 266).

Considering Kelly’s (1993) view that continuation high school students have been historically and disproportionately “excluded from the mainstream schools for violating white, middle-class norms” (p. 32), any form of social capital that can help this stigmatized and marginalized group of students effectively cope and socially advanced would be most beneficial. Research indicates several ways at-risk youth can benefit from social capital. First, social capital reduces the likelihood that students will drop out of high school which further decreases the likelihood of students experiencing negative outcomes in the future such as unemployment, low wages, poor health, and engagement in criminal activities (Croninger & Lee, 2001).

Second, increased levels of social capital were found to be related to decreased engagement in high-risk behaviors, such as substance abuse (Curran, 2007). Considering that drug use, especially the use of alcohol, methamphetamine, and marijuana, has been found to be higher for continuation students (Ruiz de Velasco, 2008), increased levels of social capital for these students may help them overcome their substance abuse. This in turn may help them to graduate on time, because continuation students who experienced consequences of drug use and illegal behaviors were found less likely to graduate (Sussman et al., 2004). Therefore, building social capital may decrease substance abuse for continuation students who engage in such high-risk behaviors, which in turn may decrease the consequences associated with such use.

Third, this population of students may also benefit from institutional supports that foster social capital if their parents are “less involved in their lives and less supportive” (Wiest et al., 2001, p. 123) or if the relationships students have with their parents and family members are not the kind of relationships that promote school success. Luckily, social capital can be built through relationships with people who are not family members (Conchas, 2006). Therefore, it is important for these students to be able to form bonds with other sources of social capital within schools such as peers, teachers, and school administrators as well as outside of school with community leaders, local business owners, and professionals from post-secondary institutions. These bonds can provide opportunities, pathways, and social mobility as well as increase students’ self-efficacy, well-being, and resiliency.

The following sections will present and examine the extent to which opportunities for bonding and bridging social capital exist for the continuation high schools that have been studied thus far by researchers in the field. For the purposes of this paper, bonding social
BONDING SOCIAL CAPITAL

“For youth with any kind of risk…the most powerful protector is relationships…especially school relationships” (Dr. Ashcroft, personal communication, October 22, 2009). Dr. Ashcroft’s emphasis on the importance of students feeling connected or bonded to others through relationships was also found in the literature on continuation high schools. Loutzenheiser (2002) found that the students in her study perceived their school as a family. They also viewed the adults, such as teachers and the principal, as their friends. In addition to the adults, students also indicated how accepting their peers at the continuation high school were of each other. Though the students were different from each other, they seemed to share a common ground which was their lack of success in a comprehensive school. These students also stated that they connected to schooling in the continuation high school because of the caring community and the personal connections they developed with their peers and the adults. Loutzenheiser asserts that “this connection … was a key to the students’ successes at the alternative school” (p. 449) and also “the foundation for students to reconnect to their schooling experience” (p. 457).

Perez and Johnson (2008) also found that their interviewees perceived their continuation high schools as having family atmospheres. The interviewees also described them as places that were more comfortable, caring, and accepting. These schools also offered extracurricular opportunities for students to connect with their peers. “In all, continuation high school students seem to benefit from small environments that promote a family-like network of acceptance and caring” (Perez & Johnson, 2008, p. 20). Perez and Johnson (2008) conclude that when students perceive adults as caring about them they are more likely to persevere in school.

Contact with caring adults, according to Werner (1992), can increase hopefulness. Hope in the future was found to be an important predictor of graduation for continuation high school students (Sussman et al., 2004). Also, hope for the future may in fact promote resiliency in students who are in danger of dropping out of school (Worrell & Hale, 2001). Resiliency, in turn, helps adolescents cope with personal difficulties and stress as well as promote positive states of mental health. Young people are more likely to be resilient when social capital is strong (Pinkerton & Dolan, 2007). Therefore, bonding between adults and at-risk students within alternative education environments like continuation high schools is important for mitigating the risk in students’ lives (Dr. Ashcroft, personal communication, October 22, 2009).

BRIDGING SOCIAL CAPITAL

In addition to providing bonding social capital, teachers and other adults within alternative settings can also provide bridging social capital when they act as a “human bridge to gate-keepers, to social networks, and to opportunities for exploring various mainstream institutions—e.g., university campuses” (Stanton-Salazar, 2001, p. 268). Putman (2000) suggests that this form of social capital may be the most beneficial form for those who have been disadvantaged. Several instances of bridging social capital were found within the literature on continuation high schools.

For example, one article describes a nurse from a continuation high school who advocates for her students and their families in regard to health care matters. She goes to great lengths to seek out local resources in order to find free services for her school’s families (Perez & Johnson, 2008). Another study found that in addition to advocating for resources for their students, some adults in continuation high schools were actively trying to foster change in how these students are perceived by others in the community (McLaughlin et al., 2008). These continuation schools had individuals who devoted “hours of personal time to building political and social capital for their programs” (p. 21).

The literature also suggests that continuation high schools can provide bridging social capital for their students by building pathways to post-secondary institutions like community colleges (McLaughlin et al., 2008; Perez & Johnson, 2008; Ruiz de Velasco, 2008; Warren, 2007). These schools have college representatives come to the schools to provide information sessions on financial aid opportunities, admission procedures, and support services. They may also take students to visit local colleges and provide assistance with admission procedures such as completing applications and financial aid paperwork. McLaughlin et al. (2008) found a continuation high school that had a designated contact at the local community college who their students reported to for assistance in order to prevent these students from feeling overwhelmed by the cumbersome aspects of college. Other schools have continuation alumni currently enrolled in community, vocational, or college courses come back to the former schools to provide informa-
tional sessions to current students about their post-secondary experiences. Most importantly, some of the continuation high schools described in the literature also provided opportunities for concurrent enrollment at the community college.

Attending adult education offered by community colleges was found by Werner (1992) in her longitudinal study on the children of Kauai to be one of the strongest agents of change for the at-risk youth in her study. This kind of program opened up opportunities for these high-risk youth to change their status from poverty stricken to working or middle class. Therefore, it is important that at-risk youth like continuation high school students are encouraged to attend post-secondary educational institutions like community or junior colleges.

Continuation high schools may also provide bridging social capital by focusing on building career pathways for their students (McLaughlin et al., 2008). They may offer programs that have professionals from various occupations within the community come to discuss with students potential career options, preparation or training needed, and local career opportunities (McLaughlin et al., 2008). They may also create partnerships with Regional Occupational Centers and Programs (ROCP) in addition to local employers in order to build pathways to jobs or internships (Ruiz de Velasco, 2008; Warren, 2007). ROCPs provide students with practical, hands-on career preparation and guidance. Many of these programs provide community based internships that can help students earn school credits while gaining valuable work experience. These programs also offer students support with completing job applications, creating resumes, and preparing for job interviews (CDOE, n.d.). Putnam (2000) states that ties at the acquaintance level have a greater chance of producing job opportunities than stronger relational ties. Therefore, it is important that continuation high schools provide their students with opportunities to develop acquaintances with business owners, entrepreneurs, and professionals.

Bridging social capital may also develop when continuation high schools focus on building partnerships with community organizations in order to provide opportunities and services to their students. Kelly (1993) found that one of the schools she studied had partnerships with the Rotary Club and the Employers Council. The former organization provided academic and vocational scholarships for students while the latter provided job opportunities to students in the work experience program. Some continuation schools create partnerships with local agencies to provide community service opportunities for their students (McLaughlin et al., 2008; Ruiz de Velasco, 2008). Participation in socially desirable tasks that involve helpfulness such as community service was found by Werner (1992) in her longitudinal study to be a key factor in whether the high-risk adolescents in her study developed into resilient adults. Therefore, this form of bridging social capital may also foster resiliency in the at-risk youth of continuation high schools.

In addition to the abovementioned forms of bridging, some continuation high schools also partner with community agencies to provide mental health, drug, and alcohol treatment services (McLaughlin et al., 2008; Perez & Johnson, 2008; Ruiz de Velasco, 2008). Some schools also partner with outside agencies to provide service learning opportunities for students. Service learning projects can help students build connections with members of their community in addition to gaining valuable and practical knowledge (Ruiz de Velasco, 2008). Ida B. Wells High School in San Francisco has partnered with a nonprofit community organization called Urban Sprouts to create an urban garden on the school’s grounds (Laurence, 2009). Through this service learning project students are learning valuable agricultural, biological, botanical, and nutritional skills. These types of projects can build connections with members of the community that can open up opportunities for these students. Werner (1992) also found that “opening up of opportunities led to major turning points in the lives of high-risk individuals” (p. 4). Therefore, continuation high schools should partner with community agencies that can provide their students with services and opportunities that aid them in turning their lives around.

**THE VARIABILITY OF CONTINUATION HIGH SCHOOLS**

Despite the evidence presented, not all of the continuation high schools studied by researchers in the field provided institutional forms of bonding and bridging social capital. Also, the amount, type, and quality of institutional supports varied widely across the researched continuation schools (McLaughlin et al., 2008; Ruiz de Velasco, 2008). Research by Ruiz de Velasco (2008) suggests that the beliefs or philosophies held by the district, administration, and staff of continuation high schools can influence the amount of institutional supports available for building social capital. He also found that the continuation high schools in his study whose focus was on fixing or adopting the school to meet students’ needs, described by Kelly (1993) as safety nets, provided more of the aforesaid forms of social capital. On the other
hand, the continuation high schools in Ruiz de Velasco’s (2008) study whose focus was on fixing or changing students, typified by Kelly (1993) as safety valves or dumping grounds, provided few, if any, institutional supports that fostered social capital for their students. The pathways present in safety valve schools were “often limited to GED, independent study, adult education, military, or entry level work as opposed to post-secondary academic instruction” (Ruiz de Velasco, 2008, p. 12). The pathways present in dumping ground schools “often serve as exit ramps to nowhere” (p. 14). The outcomes for these types of continuation schools did not compare favorably to those schools characterized as safety nets or model continuation high schools. These findings were also supported by the research of Warren (2007) and McLaughlin et al. (2008).

Besides the considerable variation in resources and opportunities for alternative education programs, McLaughlin et al. (2008) also found that those programs which provided students with positive outcomes and futures “had little to do with current policy arrangements and everything to do with personal initiative, relationships, networks, and drive to provide the best program possible for alternative education students” (p. 22) and that “Schools lacking these partnerships and connections were, by comparison, at a significant disadvantage in their efforts to meet students’ needs” (p. 21). These researchers also found that the district’s size, awareness, and commitment to such programs can be factors that affect the quality of alternative programs.

**RECOMMENDATIONS AND CONCLUSIONS**

The literature suggests that teachers in alternative environments could benefit from specialized training that focuses on how to provide at-risk students opportunities for building social capital in the forms of bonding and bridging. Presently, a lack of teaching certifications or training programs for educators who teach in alternative settings exists (Dr. Ashcroft, personal communication, October 22, 2009; Ruiz de Velasco, 2008). Therefore, training programs specific to teachers in alternative settings should be created. These programs should focus on teaching educators and adults working with at-risk youth methods and strategies for how to establish relationships with at-risk students that increase social bonding. Dr. Ashcroft spoke to “the importance of teachers in continuation high schools being trained to wait for the cognitive dissonance to settle within newly arrived students before approaching them” (personal communication, October 22, 2009). He also said these teachers could benefit from training that develops their ability to gauge whether bonding with the new environment has occurred through indicators such as changes in grooming or affect.

Besides training focused on bonding, continuation teachers could also benefit from training that focuses on methods of building social networks and garnering resources that foster bridging social capital for their students. This type of training is important because continuation students’ opportunities for bridging can be limited or bolstered by the public relations skills or social networks of their teachers, administrators, and other adults of their school community (McLaughlin et al., 2008). Therefore, training that helps educators recognize their own “resources of capital” and how to share these resources with their students could prove to be beneficial (Trainor, 2008, p. 159). Above all else, teachers should be trained on how to take care of themselves emotionally, psychologically, and physically so that they will be able to provide the support their students need without experiencing burn-out from working with this emotionally intense population.

In addition to training and professional development that caters to teachers in alternative settings, specialized training for principals of alternative schools is also needed. This training should focus on improving continuation principals’ knowledge of how the financial systems that affect their funding work. They should also learn how to determine if they are eligible for supplemental funding as well as how to apply for such funds (Ruiz de Velasco, 2008). Without such knowledge, continuation high schools are at a significant disadvantage for providing institutional supports that foster social capital. Principal training, like teacher training, should also focus on developing administrators’ abilities to build social networks that provide resources for their schools.

In addition to developing administrators’ and educators’ abilities to provide opportunities that increase social capital for their students, the social capital of continuation parents and guardians should also be developed. One way continuation high schools and community organizations can do this is by providing opportunities for parents to network with one another (Curran, 2007). They could also build parents’ social capital by providing financial seminars, workshops on parenting skills, classes focused on literacy development, or informational sessions on how to garner resources for their families. It should be noted that the literature on continuation high schools provided little evidence of social capital building for the parents and guardians of the youth who attend these alternative schools. Therefore, future research should examine the relationships that exist between home and school for continuation high
school students and the ways in which these schools are involving parents and guardians.

Furthermore, schools and districts that serve high risk youth, like those who attend continuation high schools, need to critically reflect on how they interpret the purposes of their alternative programs. If it is determined upon reflection that a continuation high school is not serving its students as a "safety net," then steps should be taken to reform the alternative program. Moreover, schools and districts need to stop blaming students and their parents and start considering the ways in which they can provide an equitable education for at-risk youth. At-risk students and the resources they need to be successful in school should be a district priority. Above all else, stronger accountability systems for alternative schools need to be put in place in order to ensure the education continuation students receive is equitable.

This paper’s examination of the studies conducted on continuation high schools and the literature on social capital suggests that social capital may indeed provide opportunities, pathways, and social mobility as well as increase at-risk students’ self-efficacy, well-being, and resilience. However, future empirical research on social capital building specifically within continuation high schools needs to be done to confirm the assertions and inferences made within this paper. The results of such studies will inform practitioners and administrators in the field of the best practices for building social capital for continuation high school students.

References


Qualifying Paper*

Biology Teachers’ Perceptions Regarding the Teaching of Evolution as a Concept

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ABSTRACT

The concept of evolution is a central topic to the study of biology and important for the development of scientific literacy. Teaching evolution as a concept is difficult for biology teachers due to various teachers' and students' perceptions that influence instruction and learning. Research has indicated that religious convictions, academic preparation in evolution and general biology as well as teachers' understanding of the nature of science all have influenced the perceptions towards evolution held by teachers. Additionally, research on this topic has identified instructional practices for the effective teaching of evolution. This paper highlights the major factors influencing teachers' perceptions towards the concept of evolution and effective instructional practices. Research questions are developed from review of the literature for possible future research.

STATEMENT OF THE PROBLEM

Scientific literacy encompasses the ability to understand scientific concepts about the natural world, evaluate issues that affect the everyday lives of people and critique emerging science and technologies. The American Association for the Advancement of Science (AAAS, 1990) assessed the need for scientific literacy in the United States and claimed “most Americans are not science-literate” (p. xv) and that U.S. students continue to rank below other nations in science.

The United States is often cited as lagging behind the rest of the world in science education. The results on many standardized science tests confirm this trend (Chester, 2009, Grigg & Lauko, 2006, Martin et al, 2008). Organizations such as the AAAS and the National Research Council (NRC) have developed content standards for science education as one way to address these testing deficiencies. In addition, the use of science content standards by science teachers is intended to help judge the quality of scientific literacy among students and promote better science education (NRC, 1996).

In the area of biology, one of the content standards is evolution. According to the NRC (1996), evolution is a unifying concept within biology that lends itself to underlying principles found across the field, thus connecting the many aspects of biology. The content area of evolution is so important to the study of biology, the official position of the National Science Teacher Association (NSTA, 2009) claims that the content standard of evolution is a “major unifying concept in science” that must be taught as part of K–12 science curricula, and if it is not then “students will not achieve the science literacy they need” (para. 1).

The study of biology, like other sciences, is an integral component for development of a scientifically literate population. Teachers are expected to develop curriculum and instruction based upon national and state standards in the quest to develop good scientific literacy in biology among other science disciplines like physics and chemistry. The NSTA (2009) suggests learning evolution is important to “unify science disciplines and provide students with powerful ideas to help them understand the natural world” (p. 104). Likewise, the National Academy of Sciences (1998) asserts, “evolution is the central organizing principle that biologists use to understand the world. To teach biology without explaining evolution deprives students of a powerful concept that brings great order and coherence to our understanding of life” (p. 3). Developing scientific literacy will then depend on how teachers perceive and teach the concept of evolution, as it brings a central focus and understanding to all of biology.

The need to develop good scientific literacy is evident in the performance results of the 2009 Massachusetts Comprehensive Assessment System (MCAS) Science and Technology/Engineering exam, where one third was below mastery. Data on the 2009 exams indicated 29% performed at the needs improvement level with 9% failing. Forty-five percent of students performed at the proficient level and 16% at the advanced level (Chester, 2009). Statewide percentage results for correctly answered questions specific to evolution on the Biology exam produced the following: evidence of evolution 73%, species classification 56% and

*Since the qualifying papers are graded, they are published as submitted; revision is not allowed.
natural selection 44% (Massachusetts Department of Elementary and Secondary Education, 2009). There is a need to address the factors, which may have contributed to the performance results on this exam, particularly on the concept of evolution as it is considered fundamental to understanding biology as a whole.

Improvement in science assessment scores and increased scientific literacy are imperative goals, so it is important to investigate some of the underlying issues related to low achievement, instructional practices and teachers’ perceptions about evolution as these are interrelated.

The concept of evolution has been at the center of debate, controversy and court cases in the context of science curriculum and instruction. The conflicts between religious conviction and misconceptions concerning the nature of science have greatly affected the education system where teachers face many obstacles in teaching the concept of evolution. According to analysis by Donnelly and Boone (2007), there are obstacles biology teachers may face when teaching the concept of evolution. Some teachers may not accept or understand the concept of evolution or feel they are not adequately prepared to teach it. It is probable that a lack of understanding of the nature of science by some teachers is one of the factors. It is also probable that a number of teachers may face community-based objections, experience stress or avoid teaching evolution because of their own personal religious convictions.

The teaching of evolution is of central importance to the understanding of biology and development of scientific literacy among students as advocated by the professional and scholarly organizations in science education. Accordingly, it is important that biology teachers understand and accept the concept of evolution and utilize effective instructional practices grounded upon high quality content standards to deliver their biology curriculum. However, based on review of the literature, the central importance of evolution within science education at the secondary level has not been fully realized. The existence of a gap between what is advocated and what has occurred has been a problem of focus for several studies. The perceptions that some biology teachers have towards evolution as a concept has shown to be a major factor of the problem, especially when perceptions are religiously based (Meadows, Doster & Jackson, 2000; Osif, 1997; Trani, 2004; Weld & McNew, 1999; Zimmerman, 1997). The inadequate academic preparation of some biology teachers in the nature of science as well in evolution and biology have also influenced perceptions (Nehm and Schonfeld, 2007; Rutledge and Mitchell, 2002) though they are not documented as much as religious influences. Additionally some research has examined use of effective instructional practices (Chuang, 2003; Duveen & Solomon, 1994; Jensen and Finley, 1995; Lawson & Worsnop, 1992) in teaching evolution, which is important for conveying the concept correctly. Until research discerns a deeper understanding of the factors that influence the inadequate presence of and teaching of evolution by some biology teachers, the deficiencies among students in scientific literacy and understanding of evolution will continue.

**REVIEW OF THE LITERATURE**

The review of the literature will focus on two strands: biology teachers’ perceptions regarding evolution as a concept and the instructional practices of teaching evolution effectively. The first part of the review will focus on the ways in which teachers understand, value, use and relate evolution as a concept to their biology pedagogy. The second part of the review will identify the types of effective instructional practices used to foster learning of evolution and understanding of the nature of science.

**Biology Teachers’ Perceptions of Evolution as a Concept**

How one perceives the world is dependent upon the senses, and ultimately the empirical information gathered is analyzed by the mind. Perception thus develops particular beliefs and attitudes about the world (Siegel, 2005). An individual teacher’s perceptions about evolution as a concept may develop certain beliefs and attitudes within the educator. These perceptions may reveal how the concept is taught and to what depth. Additionally, these perceptions may exist as a result of religious beliefs, acceptance, preparation, educational background, degree of content difficulty, amount of teaching experience, materials available, stress and self-efficacy of biology teachers.

Since the days of Charles Darwin, religious beliefs have influenced the general public in their perceptions about the concept of evolution. Not surprisingly religion has also influenced the way science teachers perceive the concept they are responsible for teaching. An understanding of the nature of science and an understanding of the theory of evolution by teachers has also played a significant role.

**Religion and the concept of evolution.** Meadows, Doster, and Jackson (2000) examined unresolved conflicts between the personal religious and philosophical backgrounds of biology teachers and the concept of...
evolution and determined that these conflicts could be resolved. A total of 17 people were interviewed who self-identified as orthodox or fundamentalist Christian. This group of participants consisted of two university science professors, a professor and two graduate students in science education, four high school biology teachers and eight prospective middle and secondary science teachers. All eleven female participants and all six males were white. The interviews focused on three primary questions: What do you believe about evolution, or the history of the Earth and of life? How are your beliefs about evolution related to your religious beliefs? Given your career interest in science, do you feel a conflict between your professional and personal beliefs and values, and if so, how do you resolve that conflict? Analysis of the transcripts allowed four major categories to emerge concerning the beliefs and conflicts of the participants.

The researchers indicated the participants used four approaches to their beliefs and conflict: i) being unaware of conflict, ii) avoiding conflict, iii) being disturbed by the conflict, and iv) managing the conflict. Following analysis of the results, the researchers concluded management of conflict to be the most effective strategy. Conflict management was effective as it allowed personal religious beliefs to remain intact while the concept of evolution was engaged openly and accurately.

Though this study focused on a small number of participants with various experiences in science education, Meadows, Doster, and Jackson (2000) suggested that understanding how teachers can learn to manage their own personal conflicts between religious beliefs and the concept of evolution may develop into further understanding of how teachers can implement effective strategies in dealing with the conflicts held by their students.

Osif (1997) investigated the evolution and religious beliefs of Pennsylvania high school teachers. The research study questioned whether science teachers were different in their views on creationism and evolution as compared to the population they teach; to English teachers as peers; and to the communities in which they teach. The focus of the study examined religious beliefs and affiliations, opinions on creationism and evolution and the influence of religious beliefs upon the subject matter they taught.

The methodology consisted of an 84-question survey administered to 132 science and English teachers, chosen from a random sample of school districts. The five-point Likert Scale survey consisted of questions related to teacher’s personal opinions concerning religious beliefs and educational issues. Twenty-four of these questions stemmed from the Christian Orthodoxy Scale and fourteen were based on statement of belief held by the National Association of Evangelicals. Demographic information was obtained on teachers’ religious affiliation, academic degrees earned, years of teaching experience and amount of participation in religion. Data collected by Osif were compared to similar studies conducted previously in three other states, Georgia, Ohio and South Dakota.

Osif found teachers in the study not only had higher religious affiliations compared to the state of Pennsylvania, but also had significantly higher affiliation with evangelical denominations. Osif concluded only six teachers in the study indicated conflict between personal beliefs and teaching evolution within the biology curriculum. Other results of the study indicated 68% of science teachers as well as 68% of the English teachers in the study agreed that the theory of evolution is central to the study of biology, while the remaining percentages did not agree. For the opinion that creation science should be taught in the public school, 48% of science teachers disagreed while 40% agreed compared to English teachers with 38% in agreement and 38% in disagreement. Remaining percentages were of no opinion. For the opinion concerning the teaching of creation science in science class, 33% of English teachers disagreed and 38% agreed, while 56% of science teachers disagreed and 37% agreed in the study. Again, remaining percentages were of no opinion.

The study itself was limited in the number of participants but did offer a picture of the how biology teachers who participated in the study compare to English teachers in their perceptions of evolution. Research on personal religious conviction and perception was limited by inclusion of Christian only participants. As extension of this study, Osif suggested to examine the understanding of the nature of science by teachers as it relates to their ability to make judgments on scientific validity.

A study by Trani (2004) set out to answer two questions. The first asked if there are significant correlations between teachers who claim that they reject evolution based upon their religious beliefs and the same teachers’ understanding of the nature of science and their understanding of the theory of evolution. The second set out to determine if teachers with a strong understanding of the theory of evolution and the nature of science accept evolution—even if they hold strong religious beliefs. Trani claimed teachers’ strong religious convictions are directly correlated to their lack of understanding of the nature of science and the theory of evolution.

Three versions of a 90-question survey were administered to 80 Oregon high school biology teachers from
three different levels of years of experience: most, average, and least. The four-section survey used Likert scaling and multiple choice questions for the first three parts to assess biology teachers’ acceptance of evolution, understanding of evolution, and understanding of the nature of science. The fourth part quantified the religious convictions of teachers using a Likert scale and 15 questions.

Trani concluded Oregon biology teachers in the study have a high level acceptance of and a high level of understanding of the theory of evolution. Results indicated a moderate to high-level understanding of the nature of science. Religious convictions were described as moderate without being religiously dogmatic or dogmatically atheistic. The concept of evolution was also found by Trani to be a central part of the biology courses taught.

Correlation of religious convictions to the understanding of the nature of science and the theory of evolution by Trani showed that teachers with strong religious convictions accept the theory of evolution less often that teachers with less religious convictions. Those who do not accept the theory of evolution were found not to present the concept in their classes. However, teachers who lacked an understanding of the theory of evolution and the nature of science, were less likely to include the concepts in class. Additionally, those with strong religious convictions compared to those with less religious convictions were less likely to include the theory of evolution in their classes.

Though the study was limited in focus on Christianity based religious convictions, Trani does provide insight in the role these convictions play in presenting the theory of evolution and the nature of science within biology classes. The implications pave the way for future study to assess if developing an understanding of the nature of science may change the way religiously convicted teachers view the theory of evolution.

A study by Zimmerman (1987) compared the opinions of Ohio biology teachers concerning the teaching of evolution and creationism with general public opinion. The goal was to determine whether biology teachers supported teaching evolution, creationism or both in addition to determining their opinions of the scientific foundation of each concept.

Methodology for this study included a 19-item questionnaire administered to 404 biology teachers from public, private and religious schools. This questionnaire included thirteen yes or no questions and three multiple-choice questions concerning personal opinions of evolution, creationism, scientific foundation and religion. Remaining questions collected demographic information including grade level and type of school taught by the participant. Data collected were compared to data gathered from similar questionnaires distributed to college students and previously polled in newspapers and popular magazines.

Through analysis of the survey, it was found that 87% of biology classes offered have some evolutionary component. Seventy-eight percent of the teachers in the study reported satisfaction with the amount of evolution coverage in their textbooks. Zimmerman concluded that 10% of teachers reported pressure not to teach evolution and 51% of teachers agreed that inclusion of creationism in the classroom meant an inclusion of religion. About 78% of the teachers in the study accepted the modern theory of evolution yet Zimmerman concluded teachers are not particularly sophisticated in their understanding of evolutionary theory. Roughly 77% of teachers reported evolutionary theory has a valid scientific foundation, while 17% concurred for creationism. The study found 38% of teachers supported the inclusion of creationism in public schools and 59% of teachers objected to the introduction of religion into public schools. Zimmerman concluded that teachers favoring religion and prayer in the public schools are more likely to teach creationism in their biology courses. Furthermore, Zimmerman indicated high school biology teachers are far more likely to support the teaching of evolution, and far less likely to support the teaching of creationism as compared to the public at large.

Though this study was limited by a 29% return response for participation, the results do offer valuable insight into the opinions of biology teachers concerning evolution and creationism. As an extension of this study, Zimmerman suggested more detailed research could develop from the parameters established by this study.

Academic preparation. Griffith and Brem (2004) conducted research to understand the conflicts or stressors teachers face when teaching evolution. The research identified personal, internal, and external stressors in addition to coping mechanisms for the stressors. By understanding identified stressors the researchers hoped to develop intervention and support strategies to alleviate stress when teaching evolution and other difficult topics.

To identify the stressors teachers experience when teaching evolution, fifteen secondary teachers from six Phoenix, Arizona area schools participated in focus groups and completed questionnaires. One questionnaire collected data on demographics and teaching background, possible sources of stress in teaching evolution, and included a visualization activity that compared teaching a unit on evolution to one on circulation. Participants also completed a questionnaire known as the State-Trait...
Anxiety Inventory, which is designed to determine anxiety levels in adults. This was intended to help assess the anxiety levels in the two teaching-units. The focus group allowed for the participants to share experiences and describe supports they believe would help them feel more at ease teaching evolution. The researchers interviewed three professors of biology and science education to add a teacher-education perspective. As these participants were separate from the teachers in the focus groups, the interviews conducted were used as supplementary data for the teacher's perspectives.

Utilizing a qualitative approach, Griffith and Brem categorized teachers in the study into three groups. The scientist group was found to have strong convictions and understanding of science and taught evolution very comfortably. Selective teachers were found to avoid connections between science and life by restricting content during the evolution unit as to avoid conflict from students or community. These teachers also were found to have religious identities that created personal conflict in teaching. Lastly, the group identified as conflicted, consisted of a set of teachers similar to selective teachers yet they explored their own personal conflicts about evolution and desired more education on the topic.

With a participant group of only 15 this study was limited in the amount of data collected. Additionally, the separate interviews used to supplement teacher perspectives should been expanded and included as part of the main study. The researchers suggested further study into personal efficacy for teachers who experienced conflict in teaching evolution. Griffith and Brem also suggested to examine other areas of controversial teaching topics (sex education, dissection, formation of the universe) to determine their controversial roots and teacher reactions to them.

Nehm and Schonfeld (2007) investigated the role of increased knowledge of evolution and the nature of science had on the preference for the teaching of evolution. The study set out to determine if teachers changed their preferences for teaching evolution with an increased knowledge after the completion of a graduate level course in evolution.

The methodology included 44 pre-certified practicing secondary biology teachers at a New York City college who voluntarily took the evolution intervention course. The participants represented a range of ethnicities with a mean age of 27 years and an average of less than two years teaching experience.

Prior to the start of the intervention course, the participants completed a questionnaire that obtained demographic information, certification goal, the extent of their personal conflicts between religion and evolution, number of biology courses completed, prior completion of courses in evolution and thoughts on the belief and inclusion of creationism in science curriculum. A Likert-type instrument was used to assess teacher knowledge and attitudes about evolution and the nature of science in addition to essay questions. Nehm and Schonfeld extracted and coded eleven variables from the analysis instrument: conflict, religiosity, biosemesters (biology course work experience), evocourse (evolution coursework experience), key concepts of natural selection, concepts of natural selection, misconceptions about natural selection, evolutionary nature of science, evolution content knowledge, teaching preferences for evolution or creationism and finally believe which asked what the participants think their students believe in.

Nehm and Schonfeld concluded that misconceptions about evolution and natural selection decreased following the course for twenty-five of the teachers but these misconceptions remained for nineteen of them. Less than 25% of the teachers included key concepts of natural selection in their questionnaire responses before and after the course. Changes in teacher knowledge of evolution increased for 75% of the participants following the course while 83% increased their knowledge of the nature of science. Half of the participants showed no change in preference for teaching creationism. Biology teacher belief preferences indicated 57% of the participants preferred that students believe and/or accept creationism, with 9% indicating a preference for creationism only. Of the teachers studied, 43% thought students should believe in evolution exclusively and 48% thought students should believe in both. Following the course, ten teachers did change their position and indicated more emphasis on belief in evolution. For teachers who preferred to teach evolution only, it was found that they differed significantly more in prior nature of science and evolution content knowledge than those who professed to teach both evolution and creationism. Nehm and Schonfeld found significant association between pre-course misconceptions and religiosity while the course provided a reduction in evolution and religious conflict for the participants. Finally the researches determined that prior coursework and number of courses in biology did not appear to be associated with the participants knowledge of evolution, natural selection, or the nature of science.

Limitations of this study included a small number of participants and the use of pre-certified teachers who lacked significant experience in teaching biology. Nehm and Schonfeld also noted that the study did not indicate if knowledge of evolution could have a threshold effect.
on preferences for teaching evolution, meaning that the course offered was limited in its ability to offer enough content to influence change in preference for teaching evolution by the participants. Future study as recommended by the researchers may examine the effects of overall knowledge level on preference position in addition to beliefs of evolution.

Weld and McNew (1999) investigated attitudes toward evolution among high school life-science teachers in Oklahoma. The purpose of the study was to determine how much of an emphasis there is on evolution, creationism or both in biology classes. Methods for the study consisted of a questionnaire administered to 224 randomly selected life science teachers from across the state of Oklahoma. The questionnaire consisted of strength of opinion items, which measured teachers’ emphasis on evolution or creationism in their course. Additionally, an open-ended question for elaboration of personal philosophies was included. Demographic information was obtained on the teachers’ years of experience, gender, school size, college of preparation and academic preparation. Weld and McNew also obtained information on teachers’ professional association memberships, sources of perceived resistance to teaching evolution, familiarity with evolution and creationism institutes, preparedness to teach evolution and use of standards.

Results indicated that 91% of teachers in this study have studied the nature or philosophy of science. Two-thirds of teachers in the study placed moderate or strong emphasis on evolution theory. On the contrary, one-third placed little, no or counter emphasis on evolutionary theory in their biology classes and one-fourth of teachers placed moderate or strong emphasis on creationism. Results showed 74% of teachers reported feeling well prepared to teach evolution and 66% agreed that teaching biology requires discussion and lab experiences on evolution. Fifty-seven percent of teachers perceive evolution as a unifying theme in biology and 58% do not fear raising controversy by teaching evolution. The results by Weld and McNew also indicated that 48% of teachers agree or strongly agree that there is much evidence for creationism.

The study was limited by in the number of participants but does offer insight into factors that influence teacher attitudes towards evolution. For further study, Weld and McNew suggested further analysis of the influence of peer associations and standards-based practice upon personal philosophies towards the theory of evolution.

A study by Trani (2004) set out to answer two questions. The first asked if there are significant correlations between teachers who claim that they reject evolution based upon their religious beliefs and the same teachers’ understanding of the nature of science and their understanding of the theory of evolution. The second set out to determine if teachers with a strong understanding of the theory of evolution and the nature of science accept evolution— even if they hold strong religious beliefs. Trani claimed teachers’ strong religious convictions are directly correlated to their lack of understanding of the nature of science and the theory of evolution.

Three versions of a 90-question survey were administered to 80 Oregon high school biology teachers from three different levels of years of experience: most, average and least. The four-section survey used Likert scaling and multiple choice questions for the first three parts to assess biology teachers’ acceptance of evolution, understanding of evolution, and understanding of the nature of science. The fourth part quantified the religious convictions of teachers using a Likert scale and 15 questions.

Trani concluded Oregon biology teachers in the study have a high level acceptance of and a high level of understanding of the theory of evolution. Results indicated a moderate to high-level understanding of the nature of science. Religious convictions were described as moderate without being religiously dogmatic or dogmatically atheistic. The concept of evolution was also found by Trani to be a central part of the biology courses taught.

Correlation of religious convictions to the understanding of the nature of science and the theory of evolution by Trani showed that teachers with strong religious convictions accept the theory of evolution less often that teachers with less religious convictions. Those who do not accept the theory of evolution were found not to present the concept in their classes. However, teachers who lacked an understanding of the theory of evolution and the nature of science, were less likely to include the concepts in class. Additionally, those with strong religious convictions compared to those with less religious convictions were less likely to include the theory of evolution in their classes.

Though the study was limited in focus on Christianity based religious convictions, Trani does provide insight in the role these convictions play in presenting the theory of evolution and the nature of science within biology classes. The implications pave the way for future study to assess if developing an understanding of the nature of science may change the way religiously convicted teachers view the theory of evolution.

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Limitations of this study included a small number of participants and the use of pre-certified teachers who lacked significant experience in teaching biology. Nehm and Schonfeld also noted that the study did not indicate if knowledge of evolution could have a threshold effect on preferences for teaching evolution, meaning that the course offered was limited in its ability to offer enough content to influence change in preference for teaching evolution by the participants. Future study as recommended by the researchers may examine the effects of overall knowledge level on preference position in addition to beliefs of evolution.

Rutledge and Mitchell (2002) researched the relationship among teachers’ conceptions, acceptance and teaching of evolutionary theory. The study utilized 552 surveys and 235 concept-mapping activities completed by Indiana public high school biology teachers. Data collected for the surveys included teachers’ academic background (credit hours in biology, coursework in evolution, coursework in nature/philosophy of science), teaching of evolution (number of days, role in the curriculum) and their acceptance of evolution. The concept mapping activity utilized concepts generated by the teachers to demonstrate their knowledge of evolution.

Rutledge and Mitchell concluded that there is a significant association between teacher acceptance of evolutionary theory and academic background in science for the participants in this study. More science based academic preparation increased acceptance of evolutionary theory. Of the teachers studied, 33% indicated that less than three days were spent teaching evolution and 43% characterized this brief teaching as avoidance. Concept maps were analyzed for overall trends and grouped into three categories based on the ideas of acceptance of evolutionary theory: non-acceptance, undecided and acceptance. Concept maps within the acceptance group contained the most detail and depth. Overall, the researchers concluded the topic of evolution does not receive enough emphasis in biology classes and academic background, especially in the nature of science, is a key indicator of acceptance of evolutionary theory.

Limited by just over 500 surveys and half as many participants in the concept-mapping portion of the study, Rutledge and Mitchell highlighted important background factors that affect the acceptance and emphasis of evolution within Indiana’s biology curriculum. The researchers suggested an exploration of instructional methods for evolution to help improve biology teachers with their teaching of evolution.

**Instructional Practices of Teaching Evolution**

Science teachers across the U.S. are charged with the helping students develop strong scientific literacy and proper understanding of science concepts. For biology teachers, the teaching of evolution is particularly important as the concept of evolution is considered to be the unifying theory in biology (NRC, 1996; NSTA, 2009). Quality instruction should be based upon local, state and national content standards (National Academy of Sciences, 1998). To be successful in teaching the concept of evolution a teacher must employ practices that foster learning and an understanding of evolution through the elicitation of prior knowledge, identification of misconceptions, and proper response to student challenges. This is important to effectively teach evolution and to allow students to make connections to all aspects of biology without fault. Biology teachers ideally should adopt and share the practices and aspects of instruction in evolution that have been successful in order to improve their teaching. Unfortunately, according to the National Academy of Sciences (1998) “there remains a paucity of instructional materials for teaching evolution and the nature of science” (p.62), indicating a need for further contribution to this area of education.

**Effective practices.** Chuang (2003) researched strategies of biology teachers in response to student questioning the validity of learning evolution in addition to their understanding of evolutionary biology.

The study surveyed 78 biology professors from eight universities throughout the state of Utah. Demographic information was collected for the participant's gender; state where advanced degree was earned; current university placement; years of teaching experience; whether an evolution course was required in the program they taught; and their opinion on the importance of understanding evolution by biology students. Participants also provided a statement of how they handled student challenges to the concept of evolution. These results were grouped into five categories. Type 1 response indicated religion and evolution are not conflicted. The nature of evolution as a scientific process supported by evidence made up type 2. Type 3 stressed that religion and science are distinctly different and type 4 advocated students handle personal conflicts by ful-
filling minimal requirements for courses. Complete avoidance of conflict and student concerns were grouped as type 5.

Of the participants, 49 described the strategies for teaching evolution when confronted by challenges from students. Type 2 strategies were most often used with 44% reporting, indicating the emphasis of the nature of science and evidence in teaching about evolution. Religion and science are advocated to be distinct as 27% focused on the type 3 approach. Remaining type 1 garnered 16%, type 4 had 12% and type 5 less than 2%.

Chuang recognized the limits of the grouped categories as constraining the professors from identifying strategies in instruction that incorporate scientific and religious perspectives on a more equal basis. The study was also limited by the small number of participants and within the context of the college level where students of the participants are most likely science majors. Further research might investigate the strategies in more detailed analysis and examine secondary school instructor responses.

Duveen and Solomon (1994) reported the use of role-playing in the classroom to help students understand the concepts and historical nature of the theory of evolution. By fusing scientific content and historical context of the content with role-playing activities, the students, as noted by the researchers, will develop empathy with characters and come to understand the context of the science through different perspectives of historical characters.

The Great Evolution Trial is the name of the role-playing activity the researchers discuss. The activity involves students taking on the roles of various people at the time of Charles Darwin, including the famous scientist as well. After forming seven groups, each group researched a character role including their background, rank, typical behavior and attitude toward Darwin’s theory. From the group study of the character, one student is chosen to take on the role as part of the classroom presentation of the trial, with others filling in as jury members and court officials.

Duveen and Solomon report that they have observed this activity performed many times and that the role-playing offers students the opportunity to actively construct their own knowledge concerning Darwin’s theories. An important note however is that the role-playing is only effective with prior knowledge gained from study leading up to this activity. Duveen and Solomon suggested students learn about the nature of science in addition to the scientific content of the subject matter.

Not only do Duveen and Solomon present a scholarly description of this area of instruction, their observations and analysis also offer interesting insights into the importance of including the nature of science and interactive learning for science. The authors supported their claims, by concluding that the best way to learn about science is to learn how scientists function as people.

Jensen and Finley (1995) investigated the use of historical arguments for conceptual change. The researches claimed that if instruction reviewed events in the development of Darwin’s theory of natural selection, then students would more readily replace their misconceptions with accurate ones.

Participants for this study included 42 students enrolled in Principles of Biology, a 10-week course intended for under prepared college students. Students in the study participated in pre and post-tests and received treatment in the form of an intervention course. The intervention at the eight-week of class consisted of two sessions of lecture and small group activities concentrated on evolution. These sessions were broken down into five sections including the general nature of evolution, Lamarckian principles, evidence opposed to Lamarck, Darwin’s theory of evolution by natural selection and the last focused on student’s solving problems from Darwin’s and Lamarck’s perspectives. The sessions included historical components that were influential in evolutionary thought and provided students the opportunity to argue perspectives. The pre and post-tests consisted of seven Likert-responses and five multiple-choice questions on evolution and Darwin. There were also three short answer questions requiring explanatory responses on evolutionary concepts.

Jensen and Finley reported that less than 25% of the pretest questions were answered from a Darwinian perspective, which indicated knowledge of Darwin was very limited among the participants. The post-test answers were 45% consistent with Darwinian evolution and showed an increase of just over seven points from the pretest. The researchers reported the increase as significant, yet remained disappointed in the strength of the gain. A categorization of the results into performance groups for pre and post test data also showed some increases. The four groups that emerged from the pretest included best understanding (BU), functional misconception (FM), correct/incomplete (CI) and worst understanding (WU). Jensen and Finley determined the BU group increased by 98% for the post-test and 33% of the initial worst responses became best responses. Additionally 65% of functional misconceptions improved. Finally the researchers concluded their data supported the success of this group of students as having successful conceptual change due to instruction that.
reviewed events in the development of Darwin's theory of natural selection.

This study was limited by the small number of participants that resulted from a high attrition rate among the full course roster of 85 students. Jensen and Finley also reported students answered fewer than 50% of the questions in strictly Darwinian terms and that here were still concepts difficult for students to understand. Future research as suggested by the researchers include expanding the instructional approach of this study to incorporate more time and to gage the time for changing specific conceptions held by the students, especially those more difficult to understand.

Lawson and Worsnop (1992) determined to identify the factors that influence student ability to learn the concept of evolution and the factors that influence student's ability to reject prior nonscientific beliefs. This study focused on reflective reasoning skills as the basis to challenge misconceptions and barriers to learning evolution.

A total of 107 students (57 male, 50 female) enrolled in three sections of a non-tracked general biology course within a suburb of Phoenix, AZ. The community and high school consisted of a low percentage of minority students and a high degree of activity in religious organizations, particularly of the Catholic and Mormon faiths. The course participants took a biology course taught by one of the researchers. Participants were pre and post tested on reflective reasoning skills, strength of religious commitment, prior declarative knowledge of evolution and prior belief in special creation or evolution using multiple choice and Likert-scale questionnaires. Instructional treatment consisted of a three-week evolution unit taught near the end of a general biology course. The unit examined variation, fossil evidence for evolution and natural selection, followed by time to reflect upon alternative hypotheses. Following instruction, declarative knowledge and change in belief in evolution were measured.

Lawson and Worsnop concluded that the instruction of the course provided as intervention did not change belief in special creation, and that reflective reasoning skills were highly dependent upon prior knowledge. Additionally, reflective reasoning was significantly related to pretest scientific beliefs and was shown to be the best predictor of post-test knowledge and knowledge gains. Reflective reasoning, according to Lawson and Worsnop was indirectly related to post-test scientific beliefs. They also concluded that their hypothesis that hypothetic-deductive reasoning facilitates the rejection of non-scientific beliefs is supported. The research also concluded that strong religious views contribute negatively to initial acceptance of evolution.

A major limitation of this study is that the researchers were the instructors for the intervention course, which may enter bias into the study. In addition the participant number was small and represented a small fraction of the school population in which the study was carried out. Lawson and Worsnop suggested that biology teachers utilize instructional time to allow students to explore alternative concepts through reasoning much like scientists do. Thus rather than convincing students of evolution students should use the skill of reasoning to arrive to understanding of evolution on their own.

**Instructional resources.** To assist teachers in implementing best instructional practices for teaching evolution, WGBH/NOVA Science Unit (2001) created the *Evolution Project*. This endeavor consists of several components: a seven-part, eight-hour television broadcast series, an extensive Web site, a far-reaching educational outreach initiative, and companion book by acclaimed science writer Carl Zimmer. According to WGBH/NOVA Science Unit, the goals of the project are to “heighten understanding of evolution and how it works, to dispel common misunderstandings, to illuminate why it is relevant to our lives, to improve its teaching, to encourage a national dialogue, and to prompt participation in all aspects of the project” (WGBH/NOVA Science Unit, 2001, about the project). Grounded in the national science standards, the projects offers case studies of instructional practices for teaching evolution concepts.

The case studies, presented in video format, show experienced biology teachers conducting lessons in evolution which not only address content, but the challenges to learning evolution as well. As students come to the study of science with their own thoughts and alternative frameworks or misconceptions, there must be instructional practices implemented that address these challenges (Driver, 1983, 1989). Ken Bingham introduces students to evolution and draws out their misconceptions through questioning so he can guide his instructional focus for teaching the concept of evolution. The case study of Bonnie Chen illustrates how she builds on her students’ prior knowledge of mutations so she can lead her class through a simulation of wading birds feeding. As the most important factor influencing learning is prior knowledge (Ausubel, 1964), identifying what students already know about the concept of evolution is a vital teaching practice for biology teachers to implement. Chen much like Marilyn Havlik, who teaches her students about the Hardy-Weinberg Principle, used simulations to assist their students in understanding of evolution concepts. Havlik
also shares strategies for dealing with conflict in evolution, including teaching students about the nature of science and the importance of evidence for understanding science. Bingham advocates for explaining the importance of evidence as well. Chen suggests open dialogue for students to voice their concerns and thoughts. WGBH/NOVA Science Unit also offers more in depth strategies for dealing with conflict in teaching evolution through *Teaching Evolution in 21st Century America*, a course designed to give teachers the background and skills they need to counter pressures to present or address religiously based alternatives to the theory of evolution.

Finally, to assist teachers and education policy makers, the National Academy of Sciences (1998) has published the book *Teaching about Evolution and the Nature of Science*, in an effort to “summarizes the overwhelming observational evidence for evolution and suggests effective ways of teaching the subject” (viii). The text also offers guidance on how to analyze and select teaching materials for evolution in addition to promoting the nature of science as a unique human endeavor.

**CONCLUSION AND POTENTIAL RESEARCH QUESTIONS**

The literature reviewed throughout this paper described some of the perceptions teachers have towards the concept of evolution and effective instructional practices of teaching evolution. The concept of evolution is central to understanding all of biology as it is widely considered to be the unifying theory (AAAS, 1990; National Academy of Sciences, 1998; NRC, 1996; NSTA, 2009). For Americans to develop a strong scientific literacy, it is important that they are taught the concept of evolution effectively and scientifically. Unfortunately, the controversial and complex nature of the concept of evolution has lent itself to questionable integrity in the context of secondary biology curriculum. Some of this been due to teachers' perceptions of the concept based upon religious convictions or academic preparation.

The literature reviewed has shown that a prime factor that has shaped teacher perception of evolution has been religion. Research has shown that when faced with teaching the concept of evolution, some teachers struggle due to their own personal religious convictions. This struggle has manifested into a poor explanation of evolution by some teachers, minimal coverage of the topic, avoidance of the subject or the addition of creationism as an alternative explanation. In contrast, the literature has also shown that some teachers are strict in their separation of religion from science and present evolution accurately and scientifically to their students.

Factors that contribute to teacher perceptions about the concept of evolution outside of religion, focus on teacher understanding of the nature of science and academic preparation for the teaching of evolution. The literature has shown that teachers with more academic background in biology, especially with coursework in evolution, tend to be more positive about teaching evolution and concentrate on the scientific nature of evolution. Teachers weak in their initial understanding of evolution have shown knowledge growth and perception change following intervention coursework as well. Remediated teachers are also less likely to include religious influences and creationism as part of their lessons. Understanding the nature of science, as shown in the literature was also a good indicator of presenting evolution accurately and having a positive perception of the concept. Studies that shed light on the understanding of the nature of science as a component to a teacher's background indicated the more experience or understanding a teacher has with the nature of science the more comfortable he or she is in teaching and presenting the scientific basis of evolution. Additionally, teachers with a strong academic preparation in the nature of science and the concept of evolution, along with longer teaching experience manage conflict with evolution more effectively.

Considering teachers can manage personal conflicts and develop positive perceptions towards the concept of evolution, instructional practices need to be effective for educating students about evolution. The literature reviewed showed key areas that need to be addressed when teaching evolution. It is suggested that teachers access the prior knowledge of students to identify misconceptions they may hold. Additionally, a lesson developed around the nature of science, with historical contexts, included may allow for effective understanding of the subject matter. Each of these aspects, interwoven within a lesson may assist teachers in dealing with student conflicts or continued misunderstanding of the topic.

Research into perceptions held by teachers of evolution as a concept and the instructional practices for teaching evolution is warranted, especially with the current state of scientific literacy in biology. The following research questions are suggested.

1. How does the knowledge of the nature of science influence understanding of evolution as a concept?
2. How do teacher perceptions of evolution affect instruction in evolution?
3. What are the essential features of a biology program of study that prepares teachers for effective teaching of evolution?
4. What are the most effective practices for teaching evolution?
5. Do biology teachers support the concept of evolution as the unifying concept in biology?
6. How do biology teachers manage conflict between religious conviction and evolution as a concept?
7. How do biology teachers in Massachusetts differ in their perceptions of evolution as compared to teachers in other states?

Research into these questions might provide educators with an understanding of the factors that affect the learning of evolution, which may affect scientific literacy. If teachers understand the basis of their perceptions towards the concept of evolution and take active steps to modify the scientific authenticity of their teaching, students will develop literacy in science more effectively. Additionally, the need to include the nature of science within biology courses at the secondary and college level may be beneficial to develop more scientific literacy among potential biology teachers.

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2011 Annual Colloquium on Educational Research and Practice

Call for Papers

Educators, researchers and graduate students are invited to submit papers that will be presented at the Sixteenth Annual Colloquium on Educational Research and Practice and published in the Colloquium Journal, vol. XVI. The papers may discuss issues and trends in different domains of Leadership and Schooling, Language Art and Literacy, and Mathematics and Science Education.

WHEN SUBMITTING A PAPER, PLEASE USE THE FOLLOWING GUIDELINES.

1. Submit an electronic version of the paper and one hard copy, an abstract, approximately 150 words, and a biographical sketch, about 30 words. All pictures and diagrams must be submitted as separate documents.

2. Use double spacing with one-inch margins.

3. For references, diagrams, etc., follow the style described in the Publication Manual of the American Psychological Association (APA), Sixth Edition.

4. Paper length must not exceed 30 pages, including pictures, tables, figures, and list of references.

5. Papers must be received by December 1, 2010.

6. Authors will be notified about the status of their papers by January 15, 2011.

7. The Colloquium will be scheduled for April 2011.

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