A Comprehensive Examination of the Arrowsmith Program At One Private School in Atlanta

Rhonda Hawkins

Follow this and additional works at: http://scholarworks.gsu.edu/eps_diss

Recommended Citation
http://scholarworks.gsu.edu/eps_diss/130

This Dissertation is brought to you for free and open access by the Department of Educational Policy Studies at ScholarWorks @ Georgia State University. It has been accepted for inclusion in Educational Policy Studies Dissertations by an authorized administrator of ScholarWorks @ Georgia State University. For more information, please contact scholarworks@gsu.edu.
ACCEPTANCE

This dissertation, A COMPREHENSIVE EXAMINATION OF THE ARROWSMITH PROGRAM AT ONE PRIVATE SCHOOL IN ATLANTA, by RHONDA B. HAWKINS, was prepared under the direction of the candidate’s Dissertation Advisory Committee. It is accepted by the committee members in partial fulfillment of the requirements for the degree, Doctor of Education, in the College of Education, Georgia State University.

The Dissertation Advisory Committee and the student’s Department Chairperson, as representatives of the faculty, certify that this dissertation has met all standards of excellence and scholarship as determined by the faculty.

__________________________________
Jami Berry, Ph.D.
Committee Chair

__________________________________
Deron Boyles, Ph.D.
Committee Member

__________________________________
Misty Overman, Ed.D.
Committee Member

__________________________________
Date

__________________________________
William L. Curlette, Ph.D.
Chairperson, Department of Educational Policy Studies

__________________________________
Paul A. Alberto, Ph.D.
Dean
College of Education
AUTHOR'S STATEMENT

By presenting this dissertation as a partial fulfillment of the requirements for the advanced degree from Georgia State University, I agree that the library of Georgia State University shall make it available for inspection and circulation in accordance with its regulations governing materials of this type. I agree that permission to quote, to copy from, or to publish this dissertation may be granted by the professor under whose direction it was written, by the College of Education’s Director of Graduate Studies, or by me. Such quoting, copying, or publishing must be solely for scholarly purposes and will not involve potential financial gain. It is understood that any copying from or publication of this dissertation which involves potential financial gain will not be allowed without my written permission.

______________________________
Rhonda Beth Hawkins
NOTICE TO BORROWERS

All dissertations deposited in the Georgia State University library must be used in accordance with the stipulations prescribed by the author in the preceding statement. The author of this dissertation is:

Rhonda Beth Hawkins
Dept of Educational Policy Studies
30 Pryor Street
Atlanta, GA 30303

The director of this dissertation is:

Dr. Jami Royal Berry
Department of Educational Policy Studies
College of Education
Georgia State University
Atlanta, GA 30303
CURRICULUM VITAE

Rhonda Beth Hawkins

ADDRESS: 30 Pryor Street, Room 450
Atlanta, GA 30303

EDUCATION:

<table>
<thead>
<tr>
<th>Degree</th>
<th>Year</th>
<th>Institution</th>
<th>Major</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ed.D.</td>
<td>2015</td>
<td>Georgia State University</td>
<td>Educational Policy Studies</td>
</tr>
<tr>
<td>M.S.</td>
<td>1982</td>
<td>East Texas State University</td>
<td>Guidance and Counseling</td>
</tr>
<tr>
<td>B.S.</td>
<td>1979</td>
<td>East Texas State University</td>
<td>Elementary Education</td>
</tr>
</tbody>
</table>

PROFESSIONAL EXPERIENCE:

- **2014- present**
  Founder and Director
  Firm Foundation Preschool

- **2010-2014**
  Principal, K3-5th Grade
  Greater Atlanta Christian School

- **2005-2010**
  Principal, Early Childhood (K3-K6)
  Greater Atlanta Christian School

PROFESSIONAL SOCIETIES AND ORGANIZATIONS

- 2014  Society of Human Resources Management (SHRM)
- 2014  Professional Association of Georgia Educators
A COMPREHENSIVE EXAMINATION OF THE ARROWSMITH PROGRAM
AT ONE PRIVATE SCHOOL IN ATLANTA

by

RHONDA HAWKINS

Under the Direction of Jami Berry

ABSTRACT

This study examined the effectiveness of the Arrowsmith Program at an Atlanta area private school during 2011-2014 school years. A mixed-methods investigation was employed using a quasi-experimental non-equivalent control group design to assess student achievement through the use of pre-test and post-test scores from the Iowa Tests of Basic Skills, a Likert-scale survey administered to parents and students, and focus groups to provide contextual data. Qualitative data was collected through the use of focus groups; one with the Arrowsmith teachers and another with the classroom teachers of Arrowsmith students. Themes from the focus groups were used to provide contextual details and teacher perceptions from differing viewpoints. This study provided information that will assist in decision-making for future parents and schools that may be considering the Arrowsmith Program. The larger educational community was provided with an awareness of and insight into a program built on the premise the brain can changed.

INDEX WORDS: Neuroplasticity, Learning disabilities, Arrowsmith Program
A COMPREHENSIVE EXAMINATION OF THE ARROWSMITH PROGRAM
AT ONE PRIVATE SCHOOL IN ATLANTA

by

RHONDA HAWKINS

A Dissertation

Presented in Partial Fulfillment of Requirements for the
Degree of
Education Doctorate
in
Educational Leadership
in
Educational Policy Studies
in
the College of Education
Georgia State University

Atlanta, GA
2015
ACKNOWLEDGMENTS

It is impossible to accomplish a goal as large as this without the help of a number of people. My sincere gratitude and appreciation go to the following individuals:

- To the doctoral cohort of which I was a part:
  
  There is no way I would have made it through the program without all your support, encouragement, and friendship. One of the joys of this doctoral program was the bond we developed. You will forever have a special place in my memory.

- To the teachers, parents, and students at the private school in this study:
  
  Thank you for willingness to share your part of the Arrowsmith experience.

- To the instructors of Georgia State University:
  
  Thank you for all the guidance and expertise you provided throughout my journey. A special thanks to Dr. Jami Royal Berry for leading the first doctoral cohort and being willing to struggle with us through the process. I am especially thankful to Dr. Berry for the guidance she provided as the chair of my doctoral committee.

- To my other committee members:
  
  Thank you for your input, guidance, and instruction throughout the dissertation process. Your knowledge and expertise were so instrumental in helping me reach my goal.

- To my husband, sons, and daughter-in-law:
  
  Thank you for all the love, encouragement, and support over the last three years. Your reassurance that I could do this was invaluable to me.
# TABLE OF CONTENTS

1  A REVIEW OF THE BRAIN, LEARNING DISABILITIES, AND BRAIN-TRAINING PROGRAMS
   Guiding Questions ................................................................. 1
   Review .................................................................................. 3
   References ............................................................................ 25

2  AN EXAMINATION OF THE ARROWSMITH PROGRAM AT ONE PRIVATE SCHOOL
   Methodology ........................................................................ 44
   Results ............................................................................... 54
   Conclusions ........................................................................ 72
   References ............................................................................ 74

APPENDICES ............................................................................. 79
Johannessen (2004) stated, “There is growing concern in the United States about the education of the students regarded as least likely to succeed in school” (p. 638). This study targeted students who struggled in school because learning was difficult for them. Students in this study were from homes of well-educated parents and were considered middle to upper class. The students were given every opportunity to thrive in school through means such as tutoring, accommodations, and remediation. However, the requirements of school were a challenge for them. As a result, the students were labeled as learning disabled.

Guiding Questions

The purpose of this dissertation was to evaluate the effectiveness of the Arrowsmith Program, a learning disabilities remediation program, at a college-prep, private school in the suburbs of Atlanta, Georgia, to ascertain if Arrowsmith impacted the students in the program. After three years of program implementation, evidence of the merit and worth of the program were being sought by this researcher of the Arrowsmith Program. The following three questions guided this inquiry:

1. Have students shown changes behaviorally and socially since beginning the Arrowsmith program in the areas of homework, following instructions, carrying out responsibilities, and cooperating with peers, siblings, teachers, and parents?

2. Did students in the Arrowsmith program for one year show an increase in mean achievement on the Iowa Tests of Basic Skills (ITBS) reading and mathematics assessment when compared to a matched comparison group?
3. What perception did the teachers of Arrowsmith students have of the students in relation to other non-Arrowsmith students?

**Definition of terms.**

*Broca’s area:* The area of the brain that is associated with the production of language and speech development.

*Cerebellum:* The area in the back of the brain that controls motor movement coordination, balance, equilibrium, and muscle tone.

*Cerebral cortex:* The layer of the brain that covers the cerebrum and the cerebellum and is known as the gray matter.

*Cogmed:* A brain training program that focuses on working memory training to help improve attention, impulse control, problem solving, and learning.

*Dyscalculia:* This is a term that refers to a wide range of disabilities involving math such as understanding numbers, learning how to manipulate numbers, and learning math facts.

*Fast ForWord:* An online reading intervention program designed for K-12 schools.

*Myelin:* A substance that forms an insulating layer around nerves.

*Neocortex:* It is part of the cerebral cortex that accounts for about 76% of the brain’s volume. It is involved in sensory perception, generation of motor commands, spatial reasoning, conscious thought, and language.

*Neurogenesis:* The process that allows neurons to be generated.

*Neuroplasticity:* The ability of the brain to reorganize and retrain itself by forming new connections between the neurons.

*Neuroscience:* The scientific study of the nervous system.

*Occipital lobe:* The visual processing center of the brain.

*Parietal cortex:* The area of the brain that integrates sensory information and is important in language processing.

*Prefrontal cortex:* The prefrontal cortex is in the very front of the brain behind the forehead and is responsible for abstract thinking, thought analysis, regulating behavior. It also regulates social control.

*Temporoparietal cortex:* An area of the brain involved in speech perceptions.
**Visuospatial:** A term referring to the skills that enable individuals to visually perceive objects and the spatial relationships among objects.

**Wernicke’s area:** The part of the brain that is involved in the recognition of spoken words and the comprehension of speech.

### Review

The purpose of this literature review was to provide a framework for the study of the Arrowsmith Program. Peer-reviewed empirical research provided the foundation for the literature review. The literature review included a discussion of mind or brain, an overview of learning disorders, and an examination of brain training programs and methods.

**Mind or brain.**

In reviewing the research, there were differences between philosophers, scholars, and scientists on the relationship between the brain and mind. One theory was the brain and mind were separate from one another while another theory viewed the brain and mind as dependent on one another (Pribram, 1986; Ruz, Acero, & Tudela, 2006; & Tarlaci, 2013). While human beings were conscious entities, they comprised biological and physical components leading to the idea that the brain and mind are different (Ruz, Acero, & Tudela, 2006). Russell (1997) stated:

> The ancient question of the dependence of mind on brain, or brain on mind, is thus reduced to linguistic convenience. In cases where we know more about the brain it will be convenient to regard the mind as dependent, but in cases where we know more about the mind it will be convenient to regard the brain as dependent. In either case, the substantial facts are the same, and the difference is only as to the degree of our knowledge (p. 289).

Pribram (1986) suggested many different approaches have been used to describe the brain/mind relationship including dualism, monism, functionalism, and theories of cognitive science. Pribram (1986) described the dualism philosophy as one that viewed the brain and mind as
identical structures but distinct units. Howard-Jones (2008) and Tarlaci (2013) suggested following the dualism philosophy purported the mind has no effect on the brain, and the brain in turn has no effect on the mind. Meissner (2009) claimed mind and body were seen as separate units in the dualism philosophy. The difficulty Meissner (2009) saw with the dualism philosophy was justifying the connection between the mind and the brain. In contrast to dualism, monism as defined by Howard-Jones (2008) was an acceptance of the idea the mind is explained by the conditions of the brain.

Functionalism was a theory within the philosophy of mind that indicated the mind could be described by the functions it performed such as its inputs and outputs (Ruz, Acero, & Tudela, 2006). According to this theory, the brain was viewed as a machine (Tarlaci, 2013). Theories from cognitive science were based on the assumption the human mind was broken into different working units with each area having a different specialization (Ruz et al., 2006). As found by Ruz et al. (2006), cognitive neuroscientists challenged the idea that mind and body-related hypotheses were completely separate from each other. Meissner (2009) concluded “the activity of the mind – conscious and unconscious, voluntary and involuntary, explicit and implicit – as produced by brain processes, but as retaining their separate and distinctive character” (p. 369) was a resolution to the debate between dualism and monism.

Neuroplasticity.

The research on neuroplasticity indicated the possibility the brain’s structure and its functional organization might change when thinking and learning took place (Fishbane, 2007; Galvan, 2010; Jokic-Begic, 2010). Studies in neuroscience illuminated the mental processes involved in learning and generated new pieces of information that could aid educators in understanding teaching and learning (Kolstad, 2012; Willis, 2008; Wolfe, 2001). It was suggested the
brain never stops changing (Fishbane, 2007; Kolstad, 2012). Furthermore, scientists believed the brain was continuously developing new capacities and storing new patterns of information based on the experiences and interactions of an individual (Ansari, 2008; Kolstad, 2012). It was thought the brain remained flexible and malleable throughout a person’s life if it was challenged with new experiences and activities and at the same time used connections that were already there (Dong & Greenough, 2004; Kolstad, 2012).

The use of technological tools such as magnetic resonance imaging (MRI), functional magnetic resonance imaging (fMRI), and electroencephalograms (EEG) (Galvan, 2010; Johnston, 2009; Jokic-Begic, 2010) were believed to substantiate the idea of neuroplasticity. The technological tools had implications for the field of education and understanding how students learn.

Ronstadt & Yellin (2010) found an increase in the understanding of how the brain developed in relation to academic abilities and learning disabilities. Frith et al. (2011) indicated there was increasing proof very specific exercises could increase specific cognitive functions. It was believed phonological processing, reading fluency, comprehension, and memory retention were influenced through patterning activities that affected the brain because of its neuroplasticity (Willis, 2009).

Understanding neuroplasticity.

The idea the brain changes, adapts, and reorganizes itself has been the focus of studies since the 1970s (Kolstad, 2012; Sagi et al., 2012). The brain’s malleability was termed as “neuroplasticity” (Burns, 2011; Sagi et al., 2012). Neuroplasticity of the brain was thought by scientists to be a result of the environment or the experiences of an individual or a combination of the environment and experiences (Fishbane, 2007). Dong and Greenough (2004) stated, “Brain plas-
ticity in the form of new neurons, generated in response to environmental and experiential factors is now a well-established experimental finding” (p. 86).

Researchers of neuroplasticity suggested the plasticity of the brain was what enabled the brain to make changes in its anatomy and functioning causing new pathways to be formed while other pathways were rearranged or discarded (Jokic-Begic, 2010; Kleim & Jones, 2008; Kolstad, 2012). These findings supported the adage of “use it or lose it.” When neurons in the brain were not used for an extended amount of time, the brain discarded them or created new neuronal connections (Hinton, Miyamoto, & Della-Chisea, 2008). This process was known as “synaptic pruning” (Kolstad, 2012). During the pruning process, cells that were inactive did not receive the blood flow from the circulatory system. When cells did not receive the necessary blood flow, they eventually self-destructed (Willis, 2008). The brain pruned up to 50 percent of its maximum potential (Stevens & Neville, 2009). Neurons constantly sought a place in the brain, and the functions used the most obtained the cortical space (Jokic-Begic, 2010).

Willis (2009) stated, “The implication is the more opportunities students have to receive, pattern, and consciously manipulate new information, the greater will be the neural network stimulation and development” (p. 335). Stevens & Neville (2009) stated that attention played a large role in neuroplasticity. Attention was a factor because a large amount of stimuli come at people all the time. Findings suggested for stimuli to make an impact on the brain, it was necessary for the individual to focus on the stimulation with a conscious effort so the connection could be made in the brain. Being exposed to new information alone was not enough to ensure learning (Kleim & Jones, 2008; Stevens & Neville, 2009). Kolstad (2012) stated, “When a certain experience was repeated fairly often the structural change in the brain would last and the new information was hard-wired into the neural pathways of the brain” (p. 3). The term “neurons that fire
together, wire together” grew out of this information (Jokic-Begic, 2010; Miller & Tallal, 2006). A research study involving juggling showed that after several weeks of practice, the juggler’s brain had increased the number of dendrites and connections in the region of the brain that was stimulated while practicing juggling (Willis, 2009).

As soon as a child was born, the child immediately received sensory input through the five senses of smell, touch, taste, sight, and hearing. The neurons in the brain appeared to look for patterns and activities that repeated themselves in order for the brain to map the patterns. A pattern repeated often seemed to be easier to access and retrieve at a later time (Miller & Tallal, 2006). Kleim and Jones (2008) identified ten specific principles important in the rehabilitation following brain damage and in learning from experiences. The ten principles were as follows:

- Use It or Lose It: Failure to drive specific brain functions can lead to functional degradation.
- Use It and Improve It: Training that drives a specific brain function can lead to an enhancement of that function.
- Specificity: The nature of the training experience dictates the nature of the plasticity.
- Repetition Matters: Induction of plasticity requires sufficient repetition.
- Intensity Matters: Induction of plasticity requires sufficient training.
- Time Matters: Different forms of plasticity occur at different times during training.
- Salience Matters: The training experience must be sufficiently salient to induce plasticity.
- Age Matters: Training-induced plasticity occurs more readily in younger brains.
- Transference: Plasticity in response to one training experience can enhance the acquisition of similar behaviors.
• Interference: Plasticity in response to one experience can interfere with the acquisition of other behaviors (Kleim & Jones, 2008, p. S227).

The principle of ‘use it or lose it’ grew out of a variety of experiments with animals where deprivation of sight or hearing led to a reduction in the animals’ ability to see or hear (Fifkova, 1969; Hubel & Wiesel, 1965; & Reale, Brugge, & Chan, 1987). The principle of ‘use it and improve it’ developed from experiments and research on animals indicating training and experience increased neuronal and synaptic responses (Castro-Alamancos & Borrel, 1995; Jones, Kleim, & Greenough, 1996; Kleim, Barbay, & Nudo, 1998; Kolb & Gibb, 1991; Nudo & Milliken, 1996; Xerri & Zennou-Azogui, 2003).

Kleim & Jones (2008) indicated changes occur in neural connectivity as a result of learning or acquiring a skill and not just simple use. The principle of ‘specificity’ evolved from a variety of studies including a study of individuals showing an improvement in corticospinal responses after training of skilled ankle movements (Perez et al., 2004). Other studies of rats indicated brain changes occurred because of learning reach and grab tasks resulting in growth in the area of the brain that connected to the trained appendage (Greenough, Larson, & Withers, 1985; Withers & Greenough, 1989).

The fourth principle of ‘repetition matters’ seemed to be necessary for neural changes to last (Kleim & Jones, 2008). This principle was realized through the study of training rats. When rats were trained on tasks requiring reaching, they did not show growth of the synapses until they had completed several days of training (Monfils & Teskey, 2004; Kleim et al., 2004). In similar experiments, rats performing the reaching tasks 400 times a day showed growth of the synapses whereas the rats only reaching 60 times a day did not show the same improvement (Kleim et al., 2004). These studies, along with others, led to the idea that ‘intensity matters’. Research studies
found that ‘time matters’, also. Trepel and Racine (1998) found synapses were more likely to degrade during the early stages of stimulation instead of the later stages. Others studies indicated time was necessary for the stabilization of memories (Dudai, 2004; Wiltgen, Brown, Talton, & Silva, 2004).

The principle of ‘salience matters’ signaled the necessity of realizing the importance of the training task. McGaugh (2004) identified the importance of emotions when consolidating memories. Kleim and Jones (2008) suggested motivation and attention were key factors in promoting saliency. The principle of ‘age matters’ was found in studies indicating changes occurred in aged brains; however, greater changes occurred in younger brains (Green, Greenough, & Schlumpf, 1983; Nieto-Sampedro & Nieto-Diaz, 2005; Salat et al., 2004; & van Praag, Shubert, Zhao, & Gage, 2005).

The final two principles of ‘transference’ and ‘interference’ indicated training in one area promoted plasticity in another area of the brain. Training in one area could impair learning in another area because of transference or interference (Kleim & Jones, 2008). Kleim and Jones (2008) cited studies by Pascual-Leone et al. (1995); Butefisch, Khurana, Kopylev, and Cohen (2004); Teskey, Flynn, Goertzen, Monfils, and Young (2003), and Moser, Krobert, Moser, and Morris (1998) that signified the transference and interference principle.

**Understanding the brain.**

The brain was thought to build patterns and at the same time examine new stimuli to see if there was a connection with existing patterns. Researchers contended this was the way the brain interpreted sensory input and responded to the input (Willis, 2009). Fundamental mechanisms involved in plasticity included neurogenesis (formation of new cells), involuntary cell death (synaptic pruning), and synaptic plasticity dependent on activity (Galvan, 2010). Approx-
imately 100 billion neurons were found in the brain and spinal cord and each of these formed thousands of connections with other neurons (Wolfe, 2001; Fishbane, 2007). Cells did not stay fixed. Cells changed, reorganized themselves, and even died off if they were not used (Fishbane, 2007; Kolstad, 2012). Scientists found electrical and chemical signals were sent between neurons that strengthened the neural pathway or formed a new pathway (Wolfe, 2001; Kolstad, 2012). These neural pathways carried information as fast as 300 feet per second (Willis, 2009).

Neurons were composed of a cellular body with its branches called dendrites or axons. The dendrites led information into the cell and the axons carried information out of the cell (Kolstad, 2012). As neurons got more use, they developed a thicker covering of fatty tissue called myelin. The point at which neurons interacted with one another was called a synapse. The synaptic connection among neurons was where most learning occurred (Kolstad, 2012). When synapses were repeatedly stimulated, neurotransmission resulted in long-term positive or negative changes (Galvan, 2010). Pascual-Leone (2006) believed two actions occurred throughout the network of neurons. First, existing connections were uncovered. Secondly, new connections between neurons occurred after existing networks were uncovered.

The brain continuously developed new capacities and stored new patterns of information based on the experiences and interactions of an individual (Ansari, 2008; Kolstad, 2012). The brain remained flexible and malleable throughout a person’s life if the brain was challenged with new experiences and activities and at the same time used connections that were already there. Research indicated new neurons could be established beyond the age of seventy (Kolstad, 2012).

**Structural and functional brain alterations.**

Changes in the brain were described as structural or functional (Galvan, 2010; Kolstad, 2012). Structural plasticity denoted the growth of new neurons (neurogenesis), the alteration of
the dissemination of neurons, and the development of new synaptic networks in response to any stimulus or experience. Feuerstein, Feuerstein, and Falik (2010) proposed structural change has four restrictions:

- Permanence: to what extent was the change preserved over time.
- Resistance: how resistant was the change to different conditions and environments.
- Flexibility/Adaptability: to what extent was it included, beyond the initial situation, in other areas of learning responses and events.
- Generalizability/Transformability: to what extent did the individual continue to be modified and create new structural changes through independent efforts (p. 14).

Anatomical changes in the brain determined by experience typically were considered structural changes (Galvan, 2010). Functional changes in the brain were a result of the firing and activation of different neurons due to a specific exercise or experience (Galvan, 2010). Functional plasticity affected memory, cognition, emotion, motor learning, and virtually all aspects of life. It appeared functional plasticity happened more often and more frequently (Sagi et al., 2010). Functional changes occurred without structural changes taking place (Galvan, 2010). The use of technological tools such as functional neuroimaging technologies of positron emission tomography (PET) and functional magnetic resonance imaging (fMRI) were used to verify changes occurred in the brain after cognitive training (Burns, 2011; Galvan, 2010; Jokic-Begic, 2010; Masson, Potvin, Riopel, Foisy, Lafortune, 2012; Poldrack, 2006).

**Identification of learning disabilities.**

Since 1977, learning disabilities were identified as “a severe discrepancy between achievement and intellectual ability” (U.S. Office of Education, 1977, p. G1082). The discrepancy model came under attack during the last decade (Fletcher, Coulter, Reschly, & Vaughn,
Siegel (1989) outlined four intrinsic assumptions of the IQ-achievement discrepancy model:

1. IQ tests measure intelligence.

2. Intelligence and achievement are independent, and the presence of a learning disability will not affect IQ test scores.

3. IQ scores predict reading and/or arithmetic scores—children with low IQ scores should be poor readers and children with high IQ scores should be good readers.

4. Individuals who have a reading disability and have low IQ scores are different from individuals who are reading disabled and have higher IQ scores (p. 469).

Researchers and educators questioned the use of the discrepancy model to identify students with learning disabilities (Kavale, et al., 2006; Frances, et al., 2005; & Moores-Abdool, et al., 2008). Using this model created an increase of students identified with a severe learning disability (Kavale, et al., 2006; Moores-Abdool, et al., 2008). In addition, there appeared to be an inconsistency across the United States when using test scores to identify students with a learning disability (Kavale, et al., 2006). Another criticism was based on the fact the discrepancy model did not inform education (Fletcher, et al., 2004; Kavale, et al., 2006). A major area of concern was whether the scores on IQ tests were reliable measures of learning disabilities (Fletcher, et al., 2006; Francis, et al., 2005; Moores-Abdool, et al., 2008; Siegel 1989).

The Response to Intervention (RTI) model was introduced as a possible alternative to the discrepancy model. At the same time, others saw RTI as partner to the discrepancy model. The RTI model provided interventions for struggling students first before intelligence and achieve-
ment testing were required (Fletcher, et al., 2004; Kavale, et al., 2006; Moores-Abdool, et al., 2008).

Others proposed the Dynamic Assessment model where educators focused on the student’s ability to learn by testing, training, and retesting (Moores-Abdool, et al., 2008). While the debate continued about the identification of learning disabilities, educators saw students daily that struggled to learn in areas of reading, math, attention, and processing.

**Reading disorders.**

Willis (2009) stated, “The increasing emergence of the neuroscience of reading will continue to provide valuable insights into how the brain becomes a successful reading organ” (p. 344). White matter and gray matter were found in the brain. The network of nerves created the gray matter where the processing of information took place (Hudson, High, & Otaiba, 2007). White matter found in deeper parts of the brain consisted of myelin-coated connective fibers that provided for the transfer of information throughout the brain. Studies showed individuals with reading disorders had less gray matter and often had less white matter (Hudson, et al., 2007).

The networks in the brain were believed to strengthen as the child encountered patterning experiences that led to reading fluency, comprehension, and memory retention (Willis, 2009). Researchers alleged the brain was designed to hear and speak, but not to read (Wolf, 2007). For reading to take place, the structures in the brain that handled visual input and language had to recycle their systems to allow reading to occur (Dehaene, 2010). Brain imaging allowed researchers to determine which networks in the brain were activated by input related to reading (Willis, 2009). The brain learned to repurpose brain structures providing for the recycling of neurons in order to accomplish the task of reading (Dehaene, 2010; Frey & Fisher, 2010). Reading was thought to occur when numerous structures in the brain interacted and created a scatter-
ing of networks (Dehaene, 2010; Frey & Fisher, 2010; Willis, 2009). Research discovered certain networks of connected neurons were extremely active when different aspects of reading such as comprehension, long-term memory storage, connected new information to prior knowledge, and responded to visual stimuli (Willis, 2009). Willis indicated (2009), “Twenty to thirty-five percent of American students experience significant reading difficulties” (p. 343).

Dehaene (2010) argued that human brains evolved over the years to the point where brain regions for language and sight were recycled to create areas in the brain for reading. The brain for some individuals was deficient in turning the language and vision into symbols thus creating reading and comprehension deficits such as dyscalculia, dyslexia or dyspraxia (Dehaene, 2010). The first area of the brain that must be activated for reading to occur was the occipital lobe where the visual features of letters were processed and stored. Then, the language areas in the temporoparietal cortex in the left hemisphere of the brain connected with the occipital lobe to interpret all the information about letter shape, word recognition, meaning, and sound (Miller & Tallal, 2006). New words were processed when stimulation was repeated enough to create a permanently stored pattern (Willis, 2009). Studies using functional imaging techniques indicated individuals with reading disorders have areas in the brain that overcompensated for the areas of their brain that were weaker thus showing less activation between the neuronal networks (Hudson et al., 2007).

Math disorders.

Along with trying to understand the neurology underlying reading, there was increasing interest in understanding the neural component for math (Kelly, 2011). However, less focus was given to math disabilities than to reading disorders (Stix, 2011; Wadlington & Wadlington, 2008). Developmental dyscalculia was a term to identify a math disability found in individuals
with normal intelligence but have difficulty processing information that deals with numbers and arithmetic (Mussolin et al., 2009).

Kelly (2011) found increasing evidence detected an underlying problem in the brain of individuals who have mathematical learning disorders. Most of the neuroimaging research on mathematics focused on how students performed mathematical operations and not on how mathematics should be taught (Lee & Fong Ng, 2011). Researchers developed different theories about the cause of developmental dyscalculia ranging from a deficit in working memory to a deficit in the ability to retrieve information from long-term memory to a deficit with number processing (Mussolin et al., 2009). Students who had other learning disabilities such as a reading disorder, language-processing disorder, or attention difficulties often struggled with math (Burns, 2011; Wadlington & Wadlington, 2008).

Executive dysfunction.

Functional brain imaging was thought to provide a new understanding of attention deficit hyperactivity disorder manifested as inattention, distractibility, and impulsivity. These symptoms fell under the broader label of executive functioning (Vaidya & Stollstorff, 2008). A learner who did not struggle with organization or focusing issues was believed to exhibit strong executive functioning characteristics (Stix, 2011). Executive functioning enabled individuals to be attentive, hold what has just been seen or heard in the working memory and to delay gratification (Stix, 2011). Working memory was the manner in which the brain held information in short-term memory, then processed it, and finally stored it in long-term memory (Jerman, Reynolds, & Swanson, 2012). Siegel (1994) and Jerman et al. (2010) indicated that deficits in reading and math seemed to have a strong connection to deficits in working memory. Children with a lan-
Language deficit were often given the diagnosis of attention deficit hyperactivity disorder (Cohen, et al., 2000).

Squire and Kandel (2000) identified three areas of the brain that were important when an individual learned a new skill. The prefrontal cortex, the parietal cortex, and the cerebellum were the three areas that enabled the student to pay attention, implement the correct movements of the skill, and sequence the steps of the skill. One theory suggested that increased stimulation from the cerebellum to the frontal-lobe increased the plasticity in the frontal lobe. The frontal-lobe was not as developed in some children with attention disorders (Willis, 2009). Fox, Tharp, and Fox (2005) explained that individuals who showed no signs of ADHD had an increase of activity in their frontal lobe as evidenced by an EEG when they were faced with tasks that required attention. On the other hand, individuals who were diagnosed with ADHD had no substantial increase in the activity of their frontal lobe.

**Processing disorders.**

Auditory processing disorders (APD) had many of the same symptoms as attention-deficit/hyperactivity disorders, reading disorders, and specific language impairments and were often found in children who had one of the other disorders (Ferguson, Hall, Riley, & Moore, 2011; Kruger, Kruger, Hugo, & Campbell, 2001; Miller, 2011). The American-Speech-Language Hearing Association (ASHA) (2005) defined auditory processing disorder by the following symptoms: (a) difficulty understanding speech when other noise is present, (b) difficulty with understanding or following verbal directions, (c) poor attention, (d) distractibility, and (e) difficulties with communicating, reading, speaking, and learning. It was difficult to distinguish between reading disorders, speech impairments, and auditory disorders because the diagnosis was dependent on behavioral manifestations that represented multiple disorders (Miller, 2011). Be-
cause the central auditory nervous system was such a complex interconnecting network, it was difficult to determine whether learning difficulties were a result of auditory processing disorders, language disorders, or reading disorders (ASHA, 2005). While the growth and improvement of technological devices to study the auditory system were promising, it was still very difficult to understand the functioning of the auditory processing system (Miller, 2011).

**Brain training methods and programs.**

Over the last 10 years, a lot of attention and interest was given to developing programs to change the brain (Gathercole, Dunning, Holmes, 2012; Soderqvist et al., 2012; Sparks, 2012). Brain research coupled with a growing knowledge of learning dysfunctions led to methods and programs designed to improve learning. Interventions that promised to change the learning capacities of the brain have been developed (Miller & Tallal, 2006; Shipstead, Hicks, & Engle, 2012). However, Novack, Lovden, and Schmiedek (2014) cautioned individuals to examine the theoretical and methodological measures used in much of the research involving brain-training programs. Many of the programs reported positive transfer effects, but in reality, the transfer was for task-specific skills. In other words, the skill that was practiced transferred in a positive way to similar tasks. However, there was little evidence that task-general effects were transferred to tasks that were not practiced (Novack, Lovden, & Schmiedek, 2014).

A review of the literature found empirical studies examining the effects of training on various aspects of cognitive functioning. One study conducted by Jaeggi, Buschkuehl, Jonides, and Perrig (2008) using a control group and a trained group found training of working memory produced a significant positive difference between the two groups using a pretest and post test protocol. Another study using a computerized training module proposed working memory training was effective in preschool aged children (Thorell, Lindqvist, Nutley, Bohlin, & Klingberg,
It was important to realize studies have found physical exercise affected brain function as much as cognitive stimulation or enrichment (Voss, Vivar, Kramer, & Praag, 2013). For purposes of this literature review, four specific brain-training programs were highlighted. The first three programs, Cogmed, FastForward, and Neurofeedback, were chosen because they appeared to this researcher to be the most well-known at the writing of this study. As an educator, this researcher had discussed the first three programs with parents and fellow colleagues. The fourth program, the Arrowsmith Program, was not as well-known. While the Arrowsmith program was in Canada since the 1980s, it had only been in the United States since the early 2000s. The next section will discuss the following four specific brain training programs: Cogmed, Fast ForWord, Neurofeedback, and Arrowsmith.

**CogMed.**

CogMed, an intervention program for working memory, promoted its ability to improve concentration, attention, impulse control, focus, social skills, and reasoning skills through the use of computer exercises designed to increase working memory (CogMed, 2011). A review of studies indicated there is not clear proof that CogMed improved reasoning skills or attention (Shipstead, et al., 2012). One study involving 253 adult participations found the training of working memory did not transfer to the improvement of overall cognitive ability. The study found only the specific tasks that were trained showed improvement, and it did not transfer to other areas (Sprenger et al., 2013). Another study of 93 participants suggested there was no improvement in fluid intelligence after repeated working memory training (Chooi & Thompson, 2012). An additional study of young adults did not show any positive transfer from brain training exercises to areas involving intelligence or working memory (Redick et al., 2013).
Hulme and Lervag (2012) conducted a thorough investigation of research studies on Cogmed and drew the following conclusions:

1. There was no evidence that CogMed training increased scores on measures of intelligence. CogMed training claimed to improve attention, but evidence did not support this claim.

2. There is limited evidence that CogMed training increased vigilance performance.

3. There is limited evidence that CogMed training reduced the symptoms of ADHD.

4. Objective measures of ADHD behavior did not show reliable improvements, and the improvements reported on subjective ratings of children’s behavior were very difficult to interpret because raters expected children who had been treated to get better and rate them accordingly.

5. There was even a lack of convincing evidence that CogMed training actually improved the thing it directly trained – working memory capacity (p. 197).

Other researchers noted that more stringent and highly developed tests needed to be developed before full confidence could be placed in CogMed (Gathercole, Dunning, & Holmes, 2012). Melby-Lervag and Hulme (2013) stated many studies of working memory programs were based on inadequate methodological standards. The guidelines for an appropriate study of working memory programs included: 1) a random assignment of participants to the different groups, 2) the trained group needed to be compared to one or more control groups, and 3) the working memory training program should be compared to a group receiving an alternate training program.

Hulme and Lervag (2012) believed any performance improvement might occur as a result of students being more familiar with the Cogmed program after several weeks of its use.

Shipstead, et al. (2012) acknowledged some studies produced positive results, but overall the
outcome was dim. Since the studies varied greatly and lacked standardization, it was difficult to place complete trust in the interpretation of the studies (Morrison & Chein, 2011).

**Fast ForWord.**

In 1996, Fast ForWord, a computer-based intervention was developed claiming to impact an individual’s processing speed. Fast ForWord based the development of the program on the underlying principle that children who struggled to read have trouble distinguishing the different sounds in words (Miller & Tallal, 2006).

Two hundred sixteen children between the ages of six and nine participated in a randomized control study of Fast ForWord where the children were divided into four different groups. One group received the Fast ForWord intervention, a second group received academic enrichment, a third group received computer-assisted language intervention, and the fourth group received individualized tutoring from a speech pathologist. The results of the study showed Fast ForWord did not improve the language skills any better than the other interventions (Gillam et al., 2008). A meta-analytic review was directed by Strong, Torgerson, Torgerson, and Hulme (2011) of the randomized, controlled studies of the Fast Forward program. The conclusion was reached that the Fast Forward program did not improve the reading or oral skills of children.

**Neurofeedback**

Neurofeedback was defined as a method of training used to treat inappropriate brain activity that manifests itself as ADHD. Neurofeedback training was intended to “improve attention, reduce impulsivity, control hyperactive behaviors, and produce long-term change” (Fox, Tharp, & Fox, 2005, p. 367). Electroencephalogram (EEG) computer systems were connected to individuals where they could see their brain waves and learn to control them (Gevensleben et al., 2010). Clinical researchers conducted a three-month trial study on 34 students. Twenty-two of
the students received neurofeedback treatment and 12 of the students chose stimulant medication as their treatment. Both groups showed improvements in behaviors associated with attention deficits (Fuchs, Birbaumer, Lutzenberger, Gruzelie, & Kaiser, 2003).

Fernandez, et al. (2007) found studies that showed positive results from neurofeedback training in the treatment of ADHD (as cited in Beaurregard & Levesquie, 2006; Butnik, 2005; Fox, et al., 2005; Leins et al., 2007;), anxiety (Abarbanel, 1999; Hammond, 2005; Moore, 2000), and affective disorders (Baehr et al., 1999; Hammond, 2005; Rosenfeld, 2000). However, the effects of neurofeedback in students with learning disabilities were very limited (Fernandez, et al., 2007). According to Loaiza, Calderon-Delgado, and Barrera-Valencia (2014) neurofeedback should not be advocated as a treatment for ADHD until more efficacious studies could be conducted on the outcomes of neurofeedback.

**Arrowsmith**

The Arrowsmith Program used computer exercises, paper-pencil tasks, listening activities, and written activities. The only studies of the Arrowsmith Program were located on the Arrowsmith website and are outlined below. ([www.arrowsmithschool.org](http://www.arrowsmithschool.org)). These studies were possibly slanted for marketing purposes.

- A study conducted in June, 1998, was based on a seven month pilot project at St. Patrick Catholic Secondary School in Toronto. Seventeen students in grade 9 participated in the study. They were assigned four Arrowsmith exercises to complete daily. Academic testing at the end of the seven months revealed an average 11% gain was made in coursework (St. Patrick Catholic Secondary School, 1998). As noted by Kemp-Koo (2013), “The small sample size, lack of a control group, use of grade equivalent measures, and
lack of tests of statistical significance greatly reduced the generalizability and validity of the results of the St. Patrick pilot study” (p.32).

- In July, 2000, a three month study compared 15 students in the Arrowsmith Program to 12 students using Autoskill’s Academy of Reading Program. The Wide Range Achievement Test Third Edition, Woodcock Reading Mastery Test-Revised, Peabody Picture Vocabulary Test, Piers-Harris Children’s Self-Concept Scale, and the AutoSkill’s Phonemic Awareness Training test were given prior to the training and then again at the end of three months. During the training period, students in the Arrowsmith group spent two class periods a day on Arrowsmith exercises. The AutoSkill group engaged in the training one class period a day. The conclusions drawn from this study indicated both groups of students showed statistically significant gains in the academic skills of word attack and phonological processing. The study was not able to generalize the results due to the small size of the groups as well as the lack of having a “no training” comparison group.

- In 2003, William Lancee, Head of Research in the Department of Psychiatry at Mount Sinai Hospital, analyzed and reported data based on pre and post measures from 12 standardized achievement and intelligence tests or subtests from the Wide Range Achievement Test-3, Woodcock Reading Mastery Test, Monroe-Sherman Achievement Test, Otis-Lennon Mental Ability Test, Peabody Picture Vocabulary Test-3, and the Arrowsmith program cognitive functions testing. The study compared 30 students participating in an Arrowsmith program offered in four elementary schools in Toronto with a control group of 10 students receiving help in a resource room in another Toronto elementary school. Grade equivalent scores and percentile scores were used to compare the students receiving Arrowsmith with the students receiving resource assistance. Signifi-
cant differences between the percentile scores were found between the Arrowsmith group and the control group (Lancee, 2003). Kemp-Koo (2013) suggested that having a comparison group strengthened the study; however, the students were chosen only because they had a learning disability. There were no other features used to match the groups. She further adds that it is difficult to generalize the results based on the small number of students.

- A three-year outcome study funded by the Donner Canadian Foundation and reported by Lancee was conducted in 2005 using 79 students enrolled in the Toronto Arrowsmith school. The study used pre and post percentile scores from the Monroe-Sherman Achievement Test, Wide Range Achievement Test, Test of Written Language, and the Woodcock Reading Mastery Test. Students were divided into three groups based on the percentile scores of the pretest. Ten students were placed in the severe group (severity level 3) since all percentile scores fell below the 25th percentile. Forty students were identified as moderately severe (severity level 2) with eight to fourteen scores falling below the 25th percentile. Twenty-nine students were classified as less severe (severity level 1). They had less than eight scores below the 25th percentile. The study found the severe group showed steady improvement over the three-year period and needed the full three years. The moderate group showed the greatest improvement in the first year but continued to improve over the next two years. The mild group had the largest gain during the first year and saw smaller gains over the next two years. This study indicated the deficit areas identified did show improvement (Lancee, 2005) However, Kemp-Koo (2013) indicated the study would have produced more accurate results if standard scores had been
analyzed instead of percentiles. She also indicated no comparison group was used even though the sample size was larger than previous studies.

- In January, 2007, a follow-up study of a Catholic School in Toronto, was completed on one hundred twenty students using standardized achievement measures from the Wide Range Achievement Test and from the Monroe-Sherman Achievement Test. Gains in academic achievement were reported quantitatively using grade equivalent scores but lacked a statistical analysis for significance (Toronto Catholic District School, 2007). Kemp-Koo (2013) emphasized this study did not contain a control group; however, the larger sample size of students along with the three year period time frame did increase the credibility of the study. Overall, the study showed academic gains based on pre and post test scores. In addition, the need for resource help decreased.

Each of these studies appeared to have limitations based on the design of the studies. Therefore, caution must be exercised when examining the results.

**Conclusion.**

This literature review included a discussion of mind and/or brain, an overview of learning disabilities, and a synopsis of brain training programs and methods. The purpose of this chapter was to provide a framework for the study of the Arrowsmith program since it was a brain-training program and was the focus of the research in this study.
References


http://dx.doi.org/10.1016/j.intell.2012.07.004


Ferguson, M. A., Hall, R. L., Riley, A., & Moore, D. R. (2011). Communication, listening, cognitive and speech perception skills in children with auditory processing disorder (APD) or


Gibson, B. S, Gondoli, D. M., Kronenberger, W. G., Johnson, A. C., Steeger, C. M., & Morrissey, R. A. (2013). Exploration of an adaptive training regimen that can target the second-


Phrases like “if he would just try harder” or “if she were not so lazy” are heard in schools on a routine basis. Mel Levine (2003) stated, “In truth, through no fault of their own, some individuals suffer from hidden handicaps that disrupt and interrupt their output. They are not lazy; they have output failure” (p. 1). Levine continued by stating:

Kids afflicted with these difficulties are the innocent victims of their own wiring. They have specific shortcomings in areas of the mind that control essential aspects of memory, language, attention, motor function, and other processes required for mastery of school subjects. (p. 2)

In an effort to help struggling students thrive, a private Atlanta area college-prep school implemented the Arrowsmith Program in August 2011. Struggling students for purposes of this study were defined as students with average to above average intelligence who found it difficult to function in a regular classroom. Many of these students were diagnosed with a learning disability defined as “a severe discrepancy between achievement and intellectual ability” (U.S. Office of Education, 1977, p. G1082). These students may have studied for hours but still failed a test. They may have had difficulty putting their thoughts on paper in a coherent manner. Struggling students also included students who had a difficult time turning in assignments and may have found it hard to focus during class. For this study, struggling students were those students who had the ability and intelligence to be successful in a college-prep school as measured by the private school entrance exams and intelligence tests, but the results were not seen in the daily classroom or in the grades they received.

The Arrowsmith Program had the following goals:

- To strengthen the learning capacities of students by targeting the underlying causes of the learning dysfunctions.
- To develop confident, self-directed learners so they could accomplish their school and career aspirations.
- To provide an opportunity for students to return to the mainstream classroom with little or no accommodations. (www.arrowsmithschool.org)

**Purpose of study.**

The purpose of this dissertation was to evaluate the effectiveness of the Arrowsmith Program, a learning disabilities remediation program, at a college-prep, private school in the suburbs of Atlanta, Georgia to ascertain if Arrowsmith had any impact on the students in the program. After three years of program implementation, evidence of the merit and worth of the program were being sought by this researcher.

**Research question 1.**

Have students shown changes behaviorally and socially since beginning the Arrowsmith program in the areas of homework, following instructions, carrying out responsibilities, and cooperating with peers, siblings, teachers, and parents?

Hypothesis: Students have shown changes behaviorally and socially since beginning Arrowsmith in the specific areas of homework, following instructions, carrying out responsibilities, and cooperating with peers, siblings, teachers, and parents.

**Research question 2.**

Did students in the Arrowsmith program for one year show an increase in mean achievement on the Iowa Tests of Basic Skills (ITBS) reading and mathematics assessment when compared to a matched comparison group?
Hypothesis: There were significant increases in mean achievement on the Iowa Tests of Basic Skills reading and mathematics assessment of students in the Arrowsmith program for one year when compared to a matched comparison group.

Null Hypothesis: There were no significant increases in mean achievement on the Iowa Tests of Basic Skills reading and mathematics assessment of students in the Arrowsmith program for one year when compared to a matched comparison group.

Research question 3.

What perception did the teachers of Arrowsmith students have of the students in relation to other non-Arrowsmith students?

Background.

For this study, it was important to discuss why and how the Arrowsmith Program became part of a college-prep, private school in Atlanta, Georgia. At the beginning of the 2010 school year, this researcher was serving as the principal of the elementary school in this study as well as the Director of the Academic Support program for kindergarten through 12th grade at the same school. An individual who had become disillusioned with her child’s existing, special needs school contacted the private school in this study to see if she could discuss the Arrowsmith program. After investigating several well-known methods of remediation, this parent found the Arrowsmith Program and enrolled her daughter in a school in Michigan that provided Arrowsmith. After a year of flying to Michigan, she contacted Atlanta area schools to see if one would be open to including the Arrowsmith Program.

The school in this study agreed to pursue information about Arrowsmith and did so over the next year. To begin the investigation of the Arrowsmith program, parents of elementary students who struggled with the rigors of school were invited to an informational meeting to see if
there were any interest in the Arrowsmith program. Approximately, 20 parents attended the initial meeting to hear the philosophy of Arrowsmith. The reactions of the parents indicated a strong interest in learning more about Arrowsmith. The next step in the investigative process included a trip to visit a school in Dallas, Texas, that implemented Arrowsmith. A classroom teacher, a parent, and this researcher flew to Dallas and observed the Arrowsmith program. In addition, the Dallas Arrowsmith teachers and the school principal at the Dallas school answered questions about implementing a program like Arrowsmith. The observations and the discussions were encouraging and thus led to the next parent meeting. At the next parent meeting, a representative from Arrowsmith traveled to Atlanta and conducted the parent meeting. The meeting was originally planned for elementary parents only; however, as parents of junior high students heard of the meeting, they asked if they could attend.

The president of the private school also attended the meeting and consequently, approved moving forward with the possibility of offering Arrowsmith at the private school. Another parent meeting was held to discuss specifics of how the program would integrate into the private school and possible difficulties the students might face. By the end of the school year, over 30 students had committed to the Arrowsmith program. The president of the school recommended a three-year implementation of Arrowsmith with an evaluation of the program at the end of the third year.

Before being approved by Arrowsmith to implement the program, the private school had to document that it was a well-established school with a strong history of educating students. Also, a contract had to be signed agreeing to send one teacher to be trained for every ten students enrolled in the Arrowsmith Program. With over 30 students committed to the program, four
teachers of the private school were trained as Arrowsmith teachers. The teachers dedicated three consecutive weeks to training in Toronto.

It was assumed by this researcher that other schools were inhibited in adopting the Arrowsmith program due to financial considerations. The initial classroom set-up cost was approximately $50,000, and the teacher training was approximately $20,000. Each year, there was an ongoing cost of three to four hundred dollars to replenish supplies. The private school in this study was able to implement Arrowsmith because of funding received from two foundations.

In addition to the start-up costs of the Arrowsmith Program, there was a yearly fee paid to the Toronto Arrowsmith school of $4500 per student involved in the program. The fee covered the assignment of a Program Coordinator designated as the overseer of the Arrowsmith program at the private school in this study. The Program Coordinator provided on-going education to the Arrowsmith teachers and monitored the progress of each student through the analysis of data that had been recorded by the Arrowsmith teachers. The quantity and quality of each student’s work on each exercise was entered into an online Record of Program. The goal and responsibility of the Program Coordinator was to ensure each student was progressing at the appropriate level as measured by the Arrowsmith benchmark goals for each exercise.

The Atlanta private school was approved to begin Arrowsmith in the fall of 2011. An additional factor to be considered when housing the Arrowsmith Program was the student’s daily schedule. The private school in this study had to adjust academic time to include four daily class periods of forty minutes each of Arrowsmith exercises. Students in the Arrowsmith program dedicated four 40-minute sessions a day to the Arrowsmith exercises. For the elementary students, the schedule was arranged so the students could be in the regular classroom for reading and math, if possible. The scheduling of the elementary students also allowed the Arrowsmith stu-
dents to attend music class and lunch with their classmates. The junior high students attended Arrowsmith for four class periods. The remaining three class periods consisted of math, language arts, and an elective. The schedule was a primary concern of parents involved with the Arrowsmith program because of the instruction the students would miss from core classes. Parents originally voiced concern the students would fall further behind in academic areas because of the missed class time.

**Methodology**

This study was a program evaluation incorporating a mixed methods design. Michael Patton (2002) described program evaluation as “the systematic collection of information about the activities, characteristics, and outcomes of programs to make judgments about the program, improve program effectiveness, and/or inform decisions about future programming” (p. 10). Patton further stated:

> Summative evaluations serve the purpose of rendering an overall judgment about the effectiveness of a program, policy, or product for the purpose of saying that the evaluand (thing being evaluated) is or is not effective and, therefore, should or should not be continued, and has or does not have the potential of being generalizable to other situations. (p. 218)

Carol Weiss (1998) explained, “evaluation tends to compare “what is” with “what should be” (p. 15).

A mixed methods research design as defined by Creswell (2008) included “collecting both quantitative and qualitative data in a single study, and analyzing and reporting this data based on a priority and sequence of the information” (p. 642). Combining qualitative and quantitative data offered a better understanding of the research question than if only one type of method was used (Creswell, 2008; Creswell & Garrett, 2008). Powell, Mihalas, Onweugbuzie, Suldo, and Daley (2008) compared a qualitative study, a quantitative study, and a mixed method study
and discovered the mixed methods added to the strength of the study and provided richer inter-
pretations.

This research study implemented a fixed mixed methods design described by Creswell and Plano (2011) where “the use of quantitative and qualitative methods were predetermined and
planned at the start of the research process, and the procedures were implemented as planned (p.
54). Before beginning the research, this investigator had decided to use a survey, focus groups,
onopen-ended questions, and the quantitative data of ITBS scores.

Creswell and Plano (2011) emphasized the importance of recognizing the reasons for
mixing qualitative and quantitative methods. This researcher chose a mixed methods approach
based on reasons outlined by Green, Caracelli, and Graham (1989) and Bryman (2006). Both
groups of researchers identified triangulation as the primary reason for a mixed methods design.
Triangulation offered the benefit of substantiating and merging of the results from the quantita-
tive and qualitative research findings (Bryman, 2006; Green, Caracelli, & Graham, 1989). Mixed
methods research provided the researcher the ability to clarify, elaborate, and create a more com-
plete picture using quantitative and qualitative methods (Bryman, 2006; Green, Caracelli, &
Graham, 1989). Bryman (2006) suggested a mixed methods design increases the credibility of a
study and augments the reliability. For these reasons, this researcher selected a mixed methods
research design using triangulation. The researcher of this study used the statistical data from the
ITBS scores, the descriptive data from the survey, and the qualitative data from the open-ended
survey questions and focus groups as a means of comparing and contrasting. Overlapping themes
appeared in each of these methods of data collection thus providing this researcher the ability to
examine the areas for any validation or discrepancy between the findings. In some instances, the
qualitative data provided additional insight and explanation of the statistical and descriptive data.
Creswell and Plano (2011) further indicated the importance of deciding where and how to mix the quantitative and qualitative strands. For purposes of this study, the researcher employed an approach where mixing occurred during the interpretation phase. Creswell and Plano (2011) indicated the researcher collects and analyzes the quantitative data as well as the qualitative data. Then, the researcher compared and integrated the results in order to make inferences or draw conclusions in what is called a convergent parallel design. Creswell and Plano (2011) stated “the convergent design is used when the researcher wants to triangulate the methods by directly comparing and contrasting quantitative statistical results with qualitative findings for corroboration and validation purposes” (p. 77).

The researcher of this study collected all the data independently of each other. The ITBS scores were analyzed using the Wilcoxon nonparametric test first. Next, this researcher ran the descriptive statistics from the surveys. Then this researcher collected the qualitative data consisting of student, teacher, and parent quotes as well as writing samples. Once each of these separate pieces of data were collected, this researcher looked at them as whole. When looking at them as a whole, this researcher was able to see where the data connected to each other. Specifically, this researcher was looking for common themes seen across the data sources.

This summative evaluation containing mixed methods incorporated (1) a quasi-experimental non-equivalent control group design that used a non-parametric test, Wilcoxon signed-ranks test to examine the difference, if any, in means on the Iowa Tests of Basic Skills, (2) a quantitative survey replicating three previous studies by Lancee was used to compare parent and student results using descriptive statistics, and (3) a qualitative narrative emerging from open-ended survey questions, teacher focus groups, and analysis of artifacts.
Though this design was for non-equivalent groups, the Arrowsmith group and comparison groups were matched using equivalent matching techniques. Boyd (2002) defined a comparison group as individuals who have not been involved in the program and who are very similar to the individuals participating in the program. The participants in this study were paired on demographic factors, specifically gender, ethnicity, socio-economic level, grade level, subject, and percentile score. The Coalition for Evidence-Based Policy (2006) suggested closely-matched comparison group studies can be the next best option if randomization was not possible. It was further suggested when using a comparison group to match on pre-intervention measures and demographic characteristics. Randomization was not possible for this study due to the small, fixed sample; therefore, the above rigorous matching process assisted in improving the study’s internal validity.

In a quantitative study, Golafshani (2003) indicated validity and reliability occur when the outcomes of the study can be duplicated and when the instrument used measures what it is expected to measure. Radhakrishna (2007) suggested a pilot test was necessary to ensure reliability of a survey. While the researcher of this study did not employ a pilot test, the survey was utilized in three previous studies conducted by Lancee. Radhakrishna (2007) further explained the validity of a survey could be strengthened when it answers the following questions:

1) Is the survey valid? Does the survey measure what it is designed to measure?
2) Does the survey embody the content?
3) Is the survey appropriate for the sample/population?
4) Is the survey thorough enough to obtain all the information needed so the purpose of the study is met?
5) Does the instrument look like a survey?
This researcher believed the survey used in this study met the above criteria because it measured what it was designed to measure, it was appropriate for the sample, it obtained the information needed for the purpose of the study, and it looked like a survey. Barbara Arrowsmith-Young granted permission for the use of the survey. However, the fact that the survey was designed by individuals connected to the Arrowsmith Program created questions about the validity of the instrument.

Quantitative data were gathered including pre-test and post-test results from the Iowa Tests of Basic Skills (ITBS). All results from the ITBS were matched pairs of scores from the reading and mathematics scale of the ITBS. Each Arrowsmith group participant’s score from the ITBS prior to the participant’s first year in the Arrowsmith program and the score on the ITBS after a school year in the Arrowsmith program were compared and the difference in pre-test and post-test scores was recorded. Similarly, the comparison groups’ scores on the ITBS were evaluated in the same manner and the difference in pre-test and post-test scores was recorded. The researcher then applied the Wilcoxon signed-ranks test using the software, Statistical Package for the Social Sciences (SPSS), to calculate the W statistic.

The Wilcoxon signed-rank test results were the non-parametric statistical test procedure applied to determine if there was a significant difference at the .05 level between the Arrowsmith group mean and the comparison group mean. Keller and Warrack (1996) indicated the Wilcoxon signed rank test is used under the following conditions: 1) The problem objective is to compare two populations; 2) The data are quantitative but not normally distributed; and 3) The samples are matched pairs (p. 507). The Wilcoxon signed-rank test was appropriate because the participants in the Arrowsmith group were paired with matching participants in the comparison group and the sample distribution was truncated due to the private school population.
In the course of three years, 52 different students were enrolled in the Arrowsmith program. Of those 52 students, 39 students were identified to participate in the study. Six of the students not identified to be in the study left the private school for financial reasons; therefore, the researcher thought it was inappropriate to contact them. The other seven students had not met the criteria for Arrowsmith, but because the parents wanted to try Arrowsmith, the private school had allowed them to participate the first year of the program. This researcher thought it was important to examine the program based on students that met the criteria for Arrowsmith and did not fall into the category of an a-typical student. A-typical was the term Arrowsmith used to identify students who were not considered typical candidates for Arrowsmith. Typical Arrowsmith students presented with disabilities such as dyslexia, math disability, language processing, and memory disabilities. Students considered A-typical at the private school in this study displayed characteristics of ADHD, asperger’s, autism, and nonverbal learning disorders all of which are considered a-typical of the regular Arrowsmith student. In addition, one student was considered a-typical because the IQ score did not fall in the average to above average range. By the fact that some students were immediately eliminated from the scope of the Arrowsmith Program created questions about the efficacy of the program.

Once the 39 students were identified, the school’s administrative assistant compiled the ITBS scores on an excel spreadsheet using de-identified numbers so the researcher would not see any identifiable information. Of the 39 students, ITBS scores for 28 students were available. The scores were not available for 11 students. At the private school in the study, the ITBS was not given until 3rd grade; therefore, some of the students had not reached a point to take the ITBS test. Other students had transferred in to the private school, and the ITBS test was not given at their previous school. After the scores were compiled for the Arrowsmith students, the adminis-
trative assistant constructed a comparison group based on the following indicators: (a) gender, (b) date of birth, (c) grade level, (d) ethnicity, and (e) close original national percentile score.

Additional descriptive data were collected through the use of parent and student surveys using a Lickert-type scale (see Appendix A). The surveys contained 44 questions with the following answer choices: (1) never a concern, (2) no change noticeable, (3) somewhat noticeable change, (4) noticeable change, (5) very noticeable change, and (6) extremely noticeable change. This survey study replicated three previous studies conducted by Lancee on Arrowsmith students in a Toronto Catholic School. Letters were sent to 79 parents describing the study and inviting them to participate. The letters included consent forms for the parents and the students to sign (See Appendix B, Appendix C, Appendix D, and Appendix E). A month later, a follow-up email was sent concerning the study and again inviting parents and students to participate. Of the 39 students identified to participate in the survey, responses were received from 19 students thus the response rate for students was 49%. Given that invitations were sent to 79 parents and 30 parents completed the survey, the response rate was 38%. Since the survey was completely anonymous, it was not known if only one parent per child took the survey or in some cases, both parents completed the survey.

The surveys were administered through SurveyMonkey and were anonymous. Because the researcher of this study was familiar with the students and parents, anonymity was desirable. Therefore, grade level, gender, and race were absent from the survey as this would have provided identifiable information to the researcher.

The first step in analyzing the survey results was to enter the raw scores from the survey into an excel spreadsheet for each student and each parent separately for all 44 of the survey questions. The 44 items on the survey were placed into similar groups thus developing con-
structs. The process for developing the constructs consisted of looking at each item separately and then combining items that were similar. For example, legibility of written work, organization and layout of written work, speed of written work, and the ability to edit written work all had the common thread of written work. Thus, the construct of written work was developed. Understanding consequences, understanding of other’s viewpoint, cooperation with parents, cooperation with siblings, cooperation with peers, cooperation with teachers, and school attendance were clustered into a group and named social interaction. All of the items were placed in groups in a similar manner. The 44 items were placed in one of the following six constructs: (a) executive planning, (b) memory and learning, (c) emotional/attitudinal, (d) written work, (e) language arts/math, and (f) social interaction.

The next step in the process was to narrow the constructs even further in order to correspond with the specific research questions. Therefore, the six constructs were narrowed to the following four categories: (1) homework, (2) responsibility, (3) following instructions, and (4) social interaction/cooperation. It was also determined the results would be clearer if the “never a concern” response was removed from the analysis since this researcher was interested in determining if there was or was not a change in the student. Therefore, the “never a concern” answer choice was not applicable to this research. Thus, a formula was entered into the excel spreadsheet removing any scores of “1”. Instead of a one to six scale, it was now the following scale: (1) no change noticeable, (2) somewhat noticeable change, (3) noticeable change, (4) very noticeable change, and (5) extremely noticeable change. Descriptive statistics were run on the four categories using SPSS.

Qualitative data were collected through open-ended questions on the surveys and the use of a narrative method of qualitative inquiry in the form of focus groups. Two focus groups were
conducted. One group included the three Arrowsmith teachers at the private school in this study, and the other group contained three classroom teachers of the Arrowsmith students in this study. Five classroom teachers were identified through purposeful sampling to participate in the study and included a second grade teacher, a third grade teacher, a fourth grade teacher, a sixth grade teacher, and a seventh grade teacher. These teachers were chosen because Arrowsmith students were placed in their classes each year, and they had the most familiarity with Arrowsmith students and the Arrowsmith program. Emails were sent to the five teachers explaining the study and asking if they would be willing to participate (Appendix F). Of the five classroom teachers, three agreed to participate in the focus group. Two of the teachers never responded to the inquiry. All three of the Arrowsmith teachers agreed to be involved in a focus group. The focus group with the Arrowsmith teachers was held after school in the Arrowsmith classroom. The focus group of the classroom teachers was held during the school day when the teachers had a common planning period. Each focus group lasted approximately one hour. The researcher began the focus groups by thanking the teachers for participating and reiterating the purpose of the focus groups. The researcher indicated the session would be recorded and assured the teachers no names would be connected to their answers. The teachers in the focus groups were asked to respond to the following open-ended statements:

1. Describe your experiences with students in the Arrowsmith Program.

2. Describe the Arrowsmith principles that you found beneficial or not beneficial in the lives of the students.

3. Describe any additional factors you consider to be significant after working with these students on a daily basis.

4. Describe the role you think the parents played in the success or failure of this program.
5. Describe any additional training or experience future teachers should have based on your experience with Arrowsmith students.

The focus group transcripts were transcribed immediately following the completion of the groups. In order to ensure the transcription was correct, the researcher listened to each recording several times while comparing what was heard to the notes that were typed. The researcher assigned a particular color of font to each speaker; therefore, it was clear when one speaker stopped and another began. Once the transcriptions were finished, the researcher emailed the classroom teachers and the Arrowsmith teachers a copy of the final transcription. They were asked to read over the report and let the researcher know if any information was not accurate. Leech and Onwuegbuzie (2007) called this member checking when individuals have the opportunity to ensure the data recorded is accurate. The researcher did not hear from any of the teachers; therefore, the researcher assumed the transcriptions were accurate.

After several readings of the transcript, common ideas and themes emerged. As topics emerged, this researcher wrote them on individual sticky notes that were spread across the floor. Next, this researcher used a technique known as the ‘scissor and sort’ or the ‘cut and paste’ method. The transcriptions were cut apart and placed under the topic heading that corresponded. Stewart, Shamdasani, & Rook (2007) found the “scissor-and-sort technique a very useful and efficient approach to analysis, but it does tend to rely very heavily on the judgment of a single analyst” (p. 117). This method created an opportunity for potential bias. To protect against potential bias, this researcher only placed excerpts in categories where the topic was explicitly stated or clearly implied.

The final pieces of data collected were writing samples from third grade students who struggled with reading. Three of the students were Arrowsmith students and three of the students
were students with no Arrowsmith intervention (See Appendix G, Appendix H, Appendix I, Appendix J, Appendix K, Appendix L). All of the samples contained spelling, punctuation, and grammatical errors. The one difference observed by this researcher was the length of writing. The Arrowsmith students appeared to write longer stories that flowed somewhat more smoothly. This result may partially be explained by the daily journal writing homework of the Arrowsmith students as well as one of the Arrowsmith exercises that focused on interpreting a picture through writing. Nevertheless, this researcher does not believe there was a major difference in the writing ability of Arrowsmith students as opposed to nonArrowsmith students.

Results

Melby-Lervag and Hulme (2013) stated many studies of working memory programs were based on inadequate methodological standards. The guidelines for an appropriate study of working memory programs included: 1) a random assignment of participants to the different groups, 2) the trained group needed to be compared to one or more control groups, and 3) the working memory training program should be compared to a group receiving an alternate training program (Melby-Lervag & Hulme, 2013). These guidelines for working memory programs could be expanded to cover all brain-training programs. This researcher acknowledged the current study did not include these guidelines; therefore, the outcomes are limited by the design of the study.

Research question 1.

Leung and Choi (2010) found students with learning difficulties also have trouble with studying, assignment completion, organization skills, and interpersonal relationships. Descriptive statistics were used to answer the first research question addressing these areas: Have students shown changes behaviorally and socially since beginning the Arrowsmith Program? Four specific areas were identified: (1) ability to complete homework, (2) ability to follow instructions, (3)
ability to carry out responsibilities, and (4) ability to cooperate with others. Data were collected through a survey using a Likert-scale with one corresponding to ‘no change noticeable’, two to ‘somewhat noticeable change’, three to “noticeable change”, four to ‘very noticeable change’, and five to ‘extremely noticeable change’. As mentioned previously, the ‘never a concern’ choice was removed when the data were analyzed.

**Homework.**

Three survey items directly related to homework and were written as “willingness to attempt homework”, “homework completion”, and “ability to complete homework independently”. Seven of thirty parents had mean scores of four or above indicating 23% of parents saw very noticeable or extremely noticeable change in reference to homework. In comparison, eight of 19 students (42%) indicated a very noticeable or extremely noticeable change in their ability to complete homework. From the open-ended survey responses, parents shared the following comments about homework:

1. “He can attend to his homework for over an hour without taking a break.”
2. “She doesn’t avoid homework anymore and she will work through things.”
3. “My child seems more willing to do homework independently.”
4. “My child is eager to do his work and any homework.”
5. “Homework does not require help from my wife. This is a drastic change, especially in math.”

The descriptive statistics along with the parent statements indicated limited change in students in the area of homework. While a few students and parents felt the Arrowsmith Program created positive change in this area, the majority of parents and students saw little change. The parents who responded appeared to insinuate a change in attitude and behavior of the stu-
dents in relation to homework. The parents used words such as “doesn’t avoid anymore”, “independently”, “eager”, and a “drastic change” to express apparent satisfaction as to how their student is handling homework now. The parent of statement five stressed the benefit of the child working more independent of constant supervision from the mother. There appeared to be significant enthusiasm in an area (math) that had previously been a struggle.

Literature findings by Polloway, Epstein, and Foley suggested homework completion was a difficult undertaking for 56% of students with learning disabilities as compared to 28% of students not diagnosed with a learning disability. Bryan and Burstein (2004) proposed the reasons for homework difficulties for students with learning disabilities included short attention span, memory deficits, poor receptive language, and lack of organizational skills. This research study indicated only 23% of parents and 42% of students believed the Arrowsmith program created a very noticeably or extremely noticeably change in homework. Only five parents made direct comments about positive changes in homework for their child.

**Following instructions.**

Following instructions consisted of three survey questions: (1) ability to follow instructions, (2) ability to understand instructions, and (3) ability to remember instructions. Five of 30 (17%) parents indicated a very noticeable to extremely noticeable change in the student’s ability to follow instructions. In comparison, 4 of 19 (21%) students felt they had made a very noticeable to extremely noticeable change in their ability to follow instructions. No specific comments were made regarding following instructions. Kemp and Carter (2006) found a significant difference between students with a learning disability and students without a disability in relation to their capacity to follow directions. Their study also discovered whole group instruction was followed less by students with learning disabilities, and teachers needed to repeat instructions to
this group of students more often. In this study, it appeared the Arrowsmith Program did not af-
flect students’ abilities to follow instructions to a large degree.

**Carrying out responsibilities.**

Carrying out responsibilities consisted of four survey items: (1) task completion, (2) tasks
completed on time, (3) carrying out responsibilities, and (4) personal responsibility. One of 30
parents (3%) believed there was a very noticeable to extremely noticeable change in their student
in the area of carrying out responsibilities. Two of nineteen students (11%) believed there was a
somewhat noticeable to extremely noticeable change in their ability to carry out responsibilities.
Parents offered the following comments on the survey:

1. “His ability to concentrate on tasks for a longer period of time was the most
   noticeable change.”
2. “He works independently much better than before the program. He is more
   focused when doing his work.”
3. “He is able to manage most of his own workload on his own this year.”
4. “My child does great at keeping his room picked up and making his bed and is getting
   a little better with his personal grooming and brushing his teeth. He still has a hard
   time remembering to do his chores.”

Four parent comments were made that included words such as ‘can concentrate on tasks
for a longer period’, ‘works independently’, ‘more focused’, and ‘able to manage most of own
workload’. One parent indicated her child still had a difficult time remembering to complete
chores. The descriptive statistics for responsibility indicated very little change as a result of the
Arrowsmith Program. One parent even commented that her child still had difficulty in complet-
ing chores.
**Ability to cooperate.**

The final area of ability to cooperate with peers, siblings, teachers, and parents consisted of four survey items: (1) cooperation with parents, (2) cooperation with siblings, (3) cooperation with peers, and (4) cooperation with teachers. Three of 30 parents (10%) saw a very noticeable to extremely noticeable difference in their student’s ability to cooperate with others. One of 19 students (5%) indicated a very noticeable to extremely noticeable change in their cooperation with others. Students responded to the open-ended question ‘how have you changed since being in the Arrowsmith program’ with the following responses:

1. “Well, I am getting better with my friend.”
2. “I get along with all my friends and family.”
3. “I am also better at talking to people in crowded situations.”
4. “I have been doing better socially.”

Parents responded to the statement ‘describe the changes you have seen in your child since beginning Arrowsmith’ with the following comments:

1. “He now has many new friends this year and some that he was close with before the program. He is also playing football for the first time, at his own request. He has requested to go on two mission trips this year with the school.”
2. “Unfortunately, I have not seen much social or emotional growth due to Arrowsmith. He felt socially isolated during the program due to always being with the same core group of kids.”
3. “My child seems to be developing a friend group that he thinks a lot of even though they don’t seem to do a lot of activities.”
4. “My child is a different child. Socially, she now wants to be involved with peers. She is more in control of her emotions.”

Although several positive comments were made by parents and students about social growth, the descriptive statistics indicated very little noticeable change in this area. Additionally, one parent commented how isolated her child felt while being in the program. Kavale and Forness suggested individuals with learning disabilities have less social acceptance and more social rejection than the typical individual (as cited in Wierner, 2004, p. 22).

In reference to the first research question, it appeared the Arrowsmith Program created limited change in the students in the areas of homework, responsibility, following instructions, and cooperation. While a small number of parents and students indicated very noticeable to extremely noticeable change, this researcher concluded the Arrowsmith Program did not have a large impact on students behaviorally and socially.

**Research question 2.**

Did students in the Arrowsmith program for one year show an increase in mean achievement on the Iowa Tests of Basic Skills reading and mathematics assessment when compared to a matched comparison group?

Hypothesis: There were significant increases in mean achievement on the Iowa Tests of Basic Skills reading and mathematics assessment of students in the Arrowsmith program for one year when compared to a matched comparison group.

Null Hypothesis: There were no significant increases in mean achievement on the Iowa Tests of Basic Skills reading and mathematics assessment of students in the Arrowsmith program for one year when compared to a matched comparison group.
As previously indicated, pretest and posttest ITBS scores were gathered for 28 Arrowsmith students. A comparison group was established matching 28 non-Arrowsmith students on gender, date of birth, grade level, ethnicity, and close original national percentile score. The Wilcoxon nonparametric signed-rank tests were conducted on reading and math scores. This quantitative data was used to answer the second research question.

**Reading.**

When the Wilcoxon parametric test was run on the ITBS reading scores of Arrowsmith students before the Arrowsmith program and compared to the comparison group, there was not enough evidence to conclude the two groups were different in reading scores before the Arrowsmith intervention at the .05 significance level. However, when the Wilcoxon parametric test was run on the same set of students after Arrowsmith intervention, there was evidence that the two groups were significantly different at the .05 level (p=.011). Thus, the null hypothesis was rejected. Although the null hypothesis was rejected based on the Wilcoxon parametric test, it was not because there was an increase in the mean achievement in reading for the Arrowsmith students. As a matter of fact, the mean score for the Arrowsmith students in reading before intervention was 60.0714. After the intervention, the mean score for the Arrowsmith students in reading was 53.9643. The first comparison group mean score was 63.5000, and the second mean score was 64.2143. The Arrowsmith group showed a decrease instead of an increase in the mean score.

One of the concerns parents had from the beginning of Arrowsmith was whether their child would fall behind in their academic subjects since so much time during the day was devoted to Arrowsmith. The results of the ITBS validated their concerns. This finding possibly verified the assumption that students would not develop at an appropriate rate in the core academic
areas especially reading. The students showed no growth in reading from one year to the next and even showed a large decrease in their reading scores.

However, on the survey, when asked to describe any changes in their child, parents made the following comments:

1. “My child has improved reading skills.”
2. “My child seems to be reading at a better speed, with the ability to try and figure out unknown words.”
3. “Reading out loud is much better. Also her willingness to read by herself has increased.”
4. “When she first started the program, she would not read in front of anyone and would avoid reading anything. Now she will read out loud and enjoys reading books.”
5. “Reading comprehension was driving force for doing Arrowsmith. He improved somewhat and it has made a positive difference.”
6. “My child started reading but still many mistakes.”
7. “The greatest changes I have seen in my child have been in her reading fluency.”

The ITBS findings indicated regression in reading scores; however, seven parents expressed improvement in reading.

Wanzek and Kent (2012) suggested students with learning disabilities need instruction in word recognition, fluency, vocabulary, and/or comprehension. They also suggested students with learning disabilities may need additional hours of intervention. Because of the four hours of Arrowsmith a day, the Arrowsmith students had limited time for reading intervention. As mentioned by the Arrowsmith teachers, the Arrowsmith exercises did not directly teach reading skills.
Math.

The Wilcoxon nonparametric test was conducted on the math IOWA scores before Arrowsmith intervention and after intervention and compared to a comparison group. The before scores indicated there was a significant difference at the .05 level before the intervention. (p=.004). The mean score for the Arrowsmith students before intervention was 53.8214 while the mean score for the control group was 62.8214. The control group scored significantly higher than the Arrowsmith group based on the before intervention scores. The Wilcoxon parametric test was run on the math scores of the Arrowsmith students after the Arrowsmith intervention as well as the comparison group. This test indicated no difference between the comparison group and the Arrowsmith group after the intervention at the .05 significance level. While there was a significant difference in scores before the Arrowsmith intervention, after the intervention there was no significant difference between the scores. In addition to the ITBS scores, parents shared the following comments:

Our son is still struggling in several areas, but he has shown a huge improvement in his math abilities.

The most notable cognitive change was in math. With Algebra, he was able to remember multi-step equations much easier than before. When entering Arrowsmith, he was barely able to retain two step directions.

His math skills continued to soar, and he is now in Honors Algebra 1 (high school credit and has an A plus). A person may think that he was always strong in math, however, the instruction and the word problems were a struggle for him.

He is doing well in school, even math, however, sometimes he has a hard time understanding what the question is asking for when taking a math test although he understands the process.

He can now tell time, do mental math. He can now play a game like Yatzee and mentally compute a score from the dice like everyone else. He can now read a clock.

Tremendous improvement in mathematical skills.
She will attempt problems and work through them. Before the program she would just give up.

Much math improvement.

From the survey, students’ comments included:

I like school and I like math and science. I understand more now than before.

It help me in math and reading and everything.

I was able to understand analogies for the first time even with much effort in the past.

One thing that stands out is reading a clock. When I would go to tutoring at my old school, my teacher would try to explain how to read the clock but I never understood it. I would always have to count. But now I can just look at the clock and read it in a second.

There are more improvements like understanding math, too.

The ability to now perform specific mathematical skills such as telling time, analogies, and mental math were credited to the Arrowsmith program as evidenced in parent statement five and student statements three and four. The statements almost contained an element of excitement and/or surprise at the improvement in math for the students.

The analysis of the math IOWA scores insinuated the Arrowsmith program had an impact on students in math. The mean scores before the Arrowsmith intervention indicated a significant difference from the mean scores of the comparison group with the Arrowsmith scores being significantly lower. After one year of Arrowsmith, there was no longer a significant difference in the math scores. While the mean scores were still lower than the comparison group, it appeared the Arrowsmith group made greater gains in math than the comparison group. In addition, eight parents commented on the math improvement they witnessed while three students mentioned a change in math. These results might be explained by the exercises performed in the Arrowsmith
classroom. Four of the ten cognitive areas (see Appendix M) targeted in the Arrowsmith classroom impact mathematical abilities. This finding also corresponded to the study on the training of working memory that found only the specific tasks that were trained showed improvement (Sprenger et al., 2013). Overall, these findings possibly signified Arrowsmith impacted students in the area of math.

**Research question 3.**

What perception did the teachers of Arrowsmith students have of the students in relation to other non-Arrowsmith students?

Two focus groups were conducted, one with classroom teachers who had Arrowsmith students in their classes and one with the Arrowsmith teachers. After analyzing the focus group transcription, four prominent themes emerged: (a) student-teacher interactions and struggles; (b) teacher needs; (c) problems of Arrowsmith at the school in the study, and (d) benefits of Arrowsmith. The focus groups did not directly answer research question three; however, rich quotes by the teacher informed this study on how Arrowsmith impacted the students.

**Student-teacher interactions and struggles.**

Both the Arrowsmith teachers and the classroom teachers made statements about their interaction with the students. The Arrowsmith teachers commented:

It was extremely rewarding and painful as a teaching experience. It was agonizing some days especially in year three to encourage the students, to find some way to make them want to keep going.

It (Arrowsmith) brings them (learning differences) right up to the surface and that is what you are focused on. Students who did not really understand their challenges at first….might have just thought everything was hunky-dory. We had to deal with that.
Classroom teacher 1 commented:

So my Arrowsmith students when it came down to the computational part, they could get it but the process is where they struggled. And, I had some students who wanted to do it their way. I say you have to show me. They became stressed out and argued with me. I also struggled with those students who had learning disabilities in reading with word problems. That became a struggle with those students.

Classroom teacher 2 responded to classroom teacher 1 and said:

I had a student who would get very frustrated. She did not want to do what I asked her to do. When I asked her to do something, she thought what she needed was right. When she thought what she was doing was right, you couldn’t get her to accept what you had to say. She had to step back and realize it was hard before she would even attempt to do it. Eventually, she came around and realized the teacher is here to help me and not to tell me what to do.

Classroom teacher 1 responded:

The students that I had I noticed are very determined and eager and want to try for that success even if they know there will be some setbacks. They still want to be treated like everybody else. They work very hard. They can be more responsible and more independent so they can do it without getting all the help.

Both the Arrowsmith teachers and the classroom teachers appeared to sense a feeling of frustration and possibly stress in the Arrowsmith students. Nevertheless, as one classroom teacher commented, “They still want to be treated like everyone else”. This perhaps provided insight into the struggle the students felt – wanting to be like everyone else, but not able to perform like everyone else. The statements by the teachers informed this study by revealing the discord felt by teachers and students on a regular basis throughout the Arrowsmith program.

**Teacher needs.**

Teachers in both focus groups mentioned specific ways to help teachers working with Arrowsmith students. The classroom teachers made the following statements:

I would have liked more research about the brain. I think if I had known (about the brain) before that would have given me a better understanding of where these
kids are and how they learn. I think I would have benefited if I had known more about brain research.

In one of our faculty meetings, the Arrowsmith teachers actually gave us some of the papers and examples of some of the things they (Arrowsmith students) do. Just to have some examples and see just what they do.

One of the Arrowsmith teachers emphatically stated:

If the Arrowsmith program is administered in a school, I think a certified teacher is a must. I feel very strongly about the characteristics needed in this type of class. Needs to be a person strong in collaboration who can talk with parents and teachers. They have to have an understanding of curriculum. Having a background in special education is important.

Another Arrowsmith teacher commented:

I learned more about the brain and the different types of learners because of this program. Being a part of this program drove me to do my own research and to take classes that demystify learning differences. All teachers should be taught about the different parts of the brain and how they relate to the way a student processes information. Finally, a teacher needs to be trained on having the difficult parent conference and the benefits of having that conference.

One of the Arrowsmith teachers responded with the following statement:

I think it is less about training or experience than it is about just your ability to accept a child where they are and want to move them forward. I think you could go to lots of training and you could have lots of experience, but if you don’t really get that each child is an unique individual and that their progress is going to look a little bit different than everybody else.

The teachers seemed to identify areas where they felt inadequate or improperly trained. They also appeared to imply they needed more training when teaching the Arrowsmith students except for one Arrowsmith teacher who believed it was more about accepting students where they were. These statements possibly reflected the teachers’ feelings these students were different from other students thus requiring teachers with more training and understanding.
Problems with Arrowsmith at the school in this study.

The Arrowsmith teachers expressed strong feelings in this area as evident by their tone of voice and embellishment on this topic. They shared the following statements:

I think there is a difference if Arrowsmith is in a clinical setting or if it is incorporated in a school of this size. There is a disconnect between the curriculum and the speed the curriculum is taught here.

One thing I didn’t realize going into it was the demands of the program. It is a very demanding, intense intervention program. The way we have it here, I think it was hard because the curriculum in the regular classroom was still out of their reach oftentimes. I think it would have helped if it could have been more at their level the other parts of their day.

I think the program is great. I think (private school in this study) is not the right place for this particular program. It is too difficult to effectively carry out this program in a school like (private school in this study).

If you can’t be patient and wait on that progress and look for those small wins for that child then it is hard to do a program like this. I think that it was very hard for them here at our school to deal with the distractions of the other part of the day.

They still go back into the classroom in a hole and the small gains they are going to make will not show up for a while. Our academic system does not foster a ‘let’s wait and see if this works’ approach. Even though there is growth and positive movement, there is still a disconnect between classroom teachers regarding learning differences and differentiation.

The teachers quoted above shared a general concern with an academic setting that was not completely supportive of a “differentiated” curriculum. If a school was strongly focused on grades and academic success, without allowing time for slow development of each child, there may be an educational disconnect. The inferences as well as the stated sentiments of the teachers denoted a trepidation of the blending of the Arrowsmith program in a college prep school that focuses on high educational rigor and standards. Further studies of the effect of school environment in which this type of program was housed may be warranted.
Benefits of Arrowsmith.

A theme that emerged from the focus groups was the positive aspects of Arrowsmith. Comments from both classroom teachers and Arrowsmith teachers were as follows:

Students who previously have felt defeated, having negative experience in the classroom, for the first time they kind of felt like they had some control.

Definitely by far the most positive benefit, it increased their confidence. They felt successful in the Arrowsmith room and sometimes they would take that confidence back into the regular classroom. Sometimes, the classroom teachers would say they started with a student that was on the outside edges of the circle – they would not participate – they would not raise their hand, but by the end of the first year in the Arrowsmith program and sometimes sooner, the students would be raising their hands. They would be volunteering.

The predictability and structure of the Arrowsmith exercises grew their confidence. They felt successful with the Arrowsmith exercises.

They had seen improvements in what they were able to do in the (regular) classroom, and they knew it took the hard work of Arrowsmith to make the improvements.

Arrowsmith definitely helped them in organizing themselves. Just the materials they had to have for all the exercises, they started taking ownership and responsibility for putting things where they belonged, getting out the materials they needed, and getting themselves ready for that cognitive exercise. I just think that helped them become a better all around prepared student.

Another key principle of the program for me was working toward personal short term goals, setting personal goals, charting progress daily, reflection on data, motivation, and acceptance which are all essential to learning environments. These should be incorporated in all types of classrooms.

With the students I have worked with, I have seen improvements with them from the beginning to the end of school. Especially one, I have seen a big difference in her social skills and academic skills.

Despite concerns that revolved around the Arrowsmith program, the teachers emphasized positive student outcomes. The increase of confidence among the students emerged as a prominent result. In addition, the teachers believed the students developed life skills such as organization, goal-setting, and motivation strategies. These qualitative findings possibly suggested an im-
pact made by the Arrowsmith program on the students that could not be measured by tests or grades. Based on research by Chapman (1988) and Marsh, Bryne, and Yeung (1999), the growth of positive self-esteem could possibly expedite the improvement of academic achievement.

It appeared the students in the Arrowsmith program experienced frustration and stress at times. These emotions were manifested in argumentative and resistant behaviors.

At the same time, the teachers seemed to express weariness at the struggle they encountered to keep the students motivated. It was mentioned during the focus group with the Arrowsmith teachers the routine nature of the exercises became monotonous thus creating boredom and a need for motivation.

Although the Arrowsmith teachers received three weeks of training in Toronto before beginning Arrowsmith, it appeared to this researcher the teachers still felt a need for additional training especially in the areas of brain research and parent communication. The comment by one of the Arrowsmith teachers that the experience was both extremely rewarding and painful created a paradoxical picture.

While the classroom teachers did not have opinions about offering the Arrowsmith program in the private school in this study, the Arrowsmith teachers felt the Arrowsmith program and the college-prep school were not a good combination. It appeared the pressure on the students to keep up with the classroom curriculum at the same time as participating in Arrowsmith was unrealistic.

Limitations.

Marshall and Rossman (as cited by Hatfield, 2013) suggested the limitations of a study provide the readers with the ability to decide about the usefulness of the study. A limitation to this study was the fact that all the participants were from one college-prep, private school in At-
lanta. Thus, this study was not representative of all students across the United States and may not be generalizable to other student populations. Another limitation was the difference in the length of time a student had participated in the Arrowsmith Program. While thirty-nine students were in the study, some students were in the first year of Arrowsmith, some in their second year, some in their third year, and some had withdrawn from Arrowsmith. In addition, the study was limited by not taking into account other factors impacting the students such as tutoring, help sessions, and mere maturation. An important limitation to this study was the connection of the researcher to the implementation of the Arrowsmith program at the private school in the study. However, it has been found internal evaluators can be beneficial to a program evaluation (Gall, Gall, & Borg, 2006; Worthen, Sanders, & Fitzpatrick, 1997).

**Bias.**

It was the goal of the researcher to try to get an honest and clear picture of the impact of the Arrowsmith Program on the students at one particular private school. To help monitor possible biases, several different types of data were collected including IOWA Test scores, results of a survey, data from two teacher focus groups, and student artifacts. Triangulating the four different types of data collected provided a greater degree of confidence in the conclusions drawn from the study.

**Ethical considerations.**

There are several possible ethical considerations in any research. This study will address the following ethical issues:

1. *Voluntary informed consent.* Three populations participated in this study. The first population consisted of students that required parental permission to participate in the study (see Appendix N). If the parents gave permission, then the students had the ability to choose to be in
the study or not be in the study. The students were informed there would be no consequences and their grades would not be affected whether a student chose to participate or not participate in the study. The second population of parents had the opportunity to give informed consent for participation. They were informed that their participation or lack of participation in this study would have no affect on their student’s enrollment in the school or in the Arrowsmith program. They were also informed their decision to participate or not participate in the study would not affect the way they were treated at the school. The third population of teachers was invited by an email from the student investigator to participate in this study after the end of the school year. If teachers chose to participate they came to a focus group meeting. The teachers had the right to say ‘no’ to participation in the focus group and no adverse consequences resulted. The focus groups were conducted after the researcher of this study was no longer in a supervisory role of the teachers. This researcher was no longer employed with the school where the Arrowsmith Program was being conducted when the focus groups occurred.

2. Anonymity and Confidentiality: The privacy of the students, parents, and teachers was guarded to the best of this researcher’s ability. Parents and students who participated were asked to complete an online survey. The survey was completely anonymous and there was no connection between the information and the name of students or parents. The data from the IOWA Tests were collected by an administrative assistant with no connection to the Arrowsmith Program. The test scores were given a de-identifying number. Any documentation connecting a student with the de-identifying number was destroyed as soon as all the data were collected and before the data were given to the student investigator. The teachers in the focus groups were identified as speaker 1, speaker 2, and speaker 3. There was no identifying documentation connecting the
names of the teachers with the coding. The audio recording of the focus groups was destroyed as soon as the recordings were transcribed.

3. **Researcher:** The researcher of this study played a role in implementing the Arrowsmith Program at the private school. By the fact that the researcher had professional ties to the location of the Arrowsmith program and the implementation of the Arrowsmith Program, ethical questions were instantly raised. As a result, the researcher took extra caution in collecting the research data, interpreting the results, and writing the final report. In addition, the researcher ceased to be employed at the private school at the end of the 2014 school year. The researcher had no supervisory roles with the students or teachers when the data was collected and analyzed.

**Future research.**

Since this dissertation was limited to a small sample of students in one specific school involving one specific program, studies of a much broader scope may provide more insight into programs designed to assist students with learning disabilities and strengthen their learning capacities. Also, this study included students from first grade through ninth grade. Research of more homogenous groups of students might provide even more information about programs such as Arrowsmith. A longitudinal study following students after graduation would be beneficial in understanding the long-term affects of Arrowsmith.

**Conclusions**

The purpose of this study was to evaluate the effectiveness of the Arrowsmith Program, a learning disabilities remediation program, at a college-prep, private school in the suburbs of Atlanta, Georgia to ascertain if Arrowsmith had any impact on the students in the program. In addition, the researcher of this study wanted to clarify if the Arrowsmith program accomplished its intended goals. The Arrowsmith Program had the following goals:
• To strengthen the learning capacities of students by targeting the underlying causes of the learning dysfunctions.

• To develop confident, self-directed learners so they can accomplish their school and career aspirations.

• To provide an opportunity for students to return to the mainstream classroom with little or no accommodations. ([www.arrowsmithschool.org](http://www.arrowsmithschool.org))

Although this study focused on a small sector of students at one private school, several conclusions were drawn. First of all, there was not enough evidence to claim the Arrowsmith Program had a major impact on the students in the program. Actually, the study revealed areas where the Arrowsmith Program actually appeared to have a negative impact on the students (i.e. reading).

Secondly, implementing Arrowsmith into a college-prep school was problematic. It was difficult to merge Arrowsmith with the high expectations of the school in this study. The conclusion was drawn that a program like Arrowsmith would be better in a setting of its own.

Thirdly, this study indicated that caution should be taken when implementing programs like Arrowsmith or other brain-training programs. More efficacious research appeared to be needed in the field of brain-training programs and the promises made by them.

Finally, the increased self-esteem of students appeared to be an outcome of the Arrowsmith Program. Perhaps the difficulty of the program coupled with the students’ ability to meet the goals of the program aided in growth of self-esteem.

This researcher hoped this study would provide insight to others who search for ways to help students who struggle with learning. Caution should be taken when implementing or en-
dorsing programs such as Arrowsmith or other brain-training programs; however, searching for ways to help struggling students should continue.
References


www.Arrowsmithschool.org
APPENDICIES

Appendix A

Arrowsmith Questionnaire

Copyright Brainex Corporation

June 1, 1999

Please complete the following questionnaire by rating any improvement in the following areas using the rating scale below:

Rating scale:
0 (was never a concern) 1 (no change noticeable) 2 (somewhat noticeable change) 3 (noticeable change) 4 (very noticeable change) 5 (extremely noticeable change)

Please complete by circling the number that applies. Please leave blank any category for which you have no information.

General:

Concentration Span

Ability to focus on task
<table>
<thead>
<tr>
<th>Skill</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Following Instructions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Listening Skills</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time management skills</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organizational skills</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task completion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Willingness to attempt homework</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Homework completion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ability to complete homework</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independently</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decision Making Process</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motivation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Understanding Consequences</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task</td>
<td>Scale</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>-------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Understanding of Other’s Viewpoint</td>
<td>0 1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Telling Time</td>
<td>0 1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tasks completed on time</td>
<td>0 1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Academic Skills</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Legibility of written work</td>
<td>0 1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organization and layout of Written work</td>
<td>0 1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed of written work</td>
<td>0 1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ability to edit written work</td>
<td>0 1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spelling</td>
<td>0 1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oral reading accuracy</td>
<td>0 1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reading Comprehension</td>
<td>0 1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Category</td>
<td>Scale</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>-------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Listening Comprehension</td>
<td>0 1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Understanding Instructions</td>
<td>0 1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remembering Instructions</td>
<td>0 1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remembering factual information</td>
<td>0 1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oral expression</td>
<td>0 1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accuracy in arithmetic computations</td>
<td>0 1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge of math facts</td>
<td>0 1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comprehension of math concepts</td>
<td>0 1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mental computation</td>
<td>0 1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vocabulary knowledge</td>
<td>0 1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Social/Personal**
<table>
<thead>
<tr>
<th>Category</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth of self-esteem</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooperation with parents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooperation with siblings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooperation with peers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooperation with teachers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carrying out responsibilities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitude towards authority</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitude towards school</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School attendance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal responsibility</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix B

Parent Consent Form

Georgia State University
Department of Educational Policy Studies

Informed Consent

A Comprehensive Examination of the Arrowsmith Program
At One Private School in Atlanta

Principal Investigator: Dr. Jami Berry
Student Investigator: Mrs. Rhonda B. Hawkins

I. Purpose:

You are being invited to participate in a research study. The purpose of this study is to evaluate the effectiveness of the Arrowsmith Program. You are being asked to be in this study because you have/had a child in the Arrowsmith Program. Parents of 39 students are being asked to participate. Being in this study will take about 20-minutes of your time to complete an online survey.
II. Procedures:

If you decide to be in the study, you will be asked to take an anonymous online survey via SurveyMonkey. You can take the survey from your own computer. There is no cost to be in this study. You will not be paid for your participation.

III. Risks

In this study, you will not have any more risks than you would in a normal day.

IV. Benefits

Being in this study will provide insight into the effectiveness of the Arrowsmith Program. Your input will help future parents and students who consider enrolling in an Arrowsmith Program. Other schools thinking about starting the Arrowsmith Program will benefit from the information of this study.

V. Voluntary Participation and Withdrawal

Participation in research is voluntary. You do not have to be in this study. You have the right to drop out of this study at any time. You have the right to answer only the questions with which you feel comfortable. You may choose not to answer questions.
VI. Confidentiality:

The survey results will be completely anonymous. The student investigator will not know who has completed the survey. Only the student principal investigator and the principal investigator will have access to the information you provide. Information may also be shared with those who make sure the study is done correctly (GSU Institutional Review Board and the Office for Human Research Protection (OHRP). The data will be kept for 1 year after completion of the study before being destroyed. The information on the survey is not connected to your name.

VII. Contact Persons:

Contact Dr. Jami Berry at 404-4413-8258 or jberry2@gsu.edu or Mrs. Rhonda B. Hawkins at 770-243-2315 or rhhawkins@greateratlantachristian.org if you have questions, concerns, or complaints about this study. You can also call if you think you have been harmed by the study. Call Susan Vogtner in the Georgia State University Office of Research Integrity at 404-413-3513 or svogtner1@gsu.edu if you want to talk to someone who is not part of the study team. You can talk about questions, concerns, or suggestions about the study. You can also call Susan Vogtner if you have questions or concerns about your rights in this study.

VIII. Copy of Consent Form to Subject:

We will give you a copy of this consent form to keep.
If you are willing to volunteer for this research, please sign below.

_________________________________________       Date _______________

Participant

_________________________________________       Date _______________

Principal Investigator or Researcher Obtaining Consent
Appendix C

Student Consent Form Age 6-10

Georgia State University
Department of Educational Policy Studies

Arrowsmith Verbal Assent Script

Students Age 6-10

Title: A Comprehensive Examination of the Arrowsmith Program
At One Private School in Atlanta

Principal Investigator: Dr. Jami Berry
Student Investigator: Mrs. Rhonda B. Hawkins

Would you be willing to be in a study about the Arrowsmith Program? If you want to be in the study, you will take on online survey that would take about 20 minutes. It is totally up to you. You can choose to be or not to be in this study. No one can make you be in the study. You can drop out of at any time. It is up to you.

Please say “yes” if you are willing to participate or “no” if you choose not to participate.
_______Yes  ______ No

____________________________________________

Child’s Name

____________________________________________  _____________________

Person Obtaining Consent     Date
Appendix D

Student Consent Form Grades 4-6

Georgia State University

Department of Educational Policy Studies

Student Assent Form

Grades 4-6

Title: A Comprehensive Examination of the Arrowsmith Program

At One Private School in Atlanta

Principal Investigator: Dr. Jami Berry

Student Investigator: Mrs. Rhonda B. Hawkins

I. Why Are You Being Asked

You are invited to be a part of a research study. This study is to see if the Arrowsmith Program does what it says it will do.

II. What You Will Be Asked to Do
If you decide to be a part of the study, you will be asked to take a survey on the computer. You will be given time at school to take the survey. It will take about 20 minutes.

III. Will This Study Be Hurtful

There will be no more chance of being hurt than you would face in a normal day.

IV. How Will This Study be Helpful

By being in this study, you will help other parents and students see what happens when a student is in Arrowsmith. You will also help other schools that are thinking about starting Arrowsmith know what to expect.

V. Do You Have to Be in This Study

You do not have to be in this study. Your parents or teachers cannot make you be in this study. If you decide to be in this study and change your mind, you have the right to drop out at any time.

If you agree to do this study, please sign below.

________________________________________      Date ___________________
Student
Appendix E

Student Consent Form Grades 7-9

Georgia State University
Department of Educational Policy Studies

Student Assent Form
Grades 7-9

A Comprehensive Examination of the Arrowsmith Program
At One Private School in Atlanta

Principal Investigator: Dr. Jami Berry
Student Investigator: Mrs. Rhonda B. Hawkins

I. Purpose:

You are being invited to be in a research study. This study is to trying to find out how well the Arrowsmith Program did what it said it would do. You are being asked to be in this study because you are currently in Arrowsmith or have in the past been in the Arrowsmith Pro-
gram. A total of 39 students are being asked to participate. You will spend about 20-minutes of your time completing an online survey if you are in this study.

II. Procedures:

If you decide to be in this study, you will be asked to take an online survey. Your name will not be connected to the survey. You can take the survey from your own school issued laptop computer at a time that is best for you. There is no cost to be in this study. You will not be receive any money or grade for being in the study.

III. Risks

In this study, you will not have any more risks than you would in a normal day.

IV. Benefits

Being in this study will help others know if the Arrowsmith Program does what it says it will do. Your input will help other parents and students know what to expect from being in Arrowsmith. It will help parents know if they should sign their child up for Arrowsmith.

V. Voluntary Participation and Withdrawal
You have a choice to be in this study. You do not have to be in this study. If you decide to be in the study and change your mind, you have the right to drop out at any time. You have the right to answer only the questions with which you feel comfortable. You may choose not to answer questions. You can stop being in the study at any time.

VI. Confidentiality:

The survey results will not be connected to your name. The researcher will not know who answered the survey. This assent form with your name on it will be kept in a locked cabinet in the researcher’s office.

VII. Contact Persons:

Contact Dr. Jami Berry at 404-4413-8258 or jberry2@gsu.edu or Mrs. Rhonda B. Hawkins at 770-243-2315 or rhhawkins@greateratlantachristian.org if you have questions or concerns about this study. You can also call if you think you have been harmed by the study. Call Susan Vogtner in the Georgia State University Office of Research Integrity at 404-413-3513 or svogtner1@gsu.edu if you want to talk to someone who is not part of the study team. You can talk about questions, concerns, or suggestions about the study. You can also call Susan Vogtner if you have questions or concerns about your rights in this study.
If you are willing to be a part of this research, please sign below.

_______________________________________       Date _______________

Student

_______________________________________   Date _______________________

Researcher
Appendix F

Consent Form for Teachers

Georgia State University
Department of Educational Policy Studies

Informed Consent

Title: A Comprehensive Examination of the Arrowsmith Program
At One Private School in Atlanta

Principal Investigator: Dr. Jami Berry
Student Investigator: Mrs. Rhonda B. Hawkins

I. Purpose:

You are invited to participate in the above titled research study. The purpose of this study is to evaluate the effectiveness of the Arrowsmith Program. You are invited to participate because of your role as an educator of students involved in the Arrowsmith Program. A total of six
teachers will be recruited for this study. Participation will require approximately one hour after school from 3:15-4:15 on one school day.

II. Procedures:

If you decide to participate, you will be in a focus group. The focus group will be audio recorded using a portable recording device. There will be a total of three teachers in each focus group. Each focus group will only meet once respectively in the conference room of the Young Learners’ Hall from 3:15-4:15 on a date to be determined. There is no cost to participate in this study, and you will not be compensated for your participation.

III. Risks

In this study, you will not have any more risks than you would in a normal day.

IV. Benefits

Participation in this study will provide insight into the effectiveness of the Arrowsmith Program. By participating, your input will benefit other parents and students who consider enrolling in an Arrowsmith Program in the future. Your input will also benefit other potential schools that are contemplating implementing Arrowsmith. There is hope that this study will add to the understanding of the brain in relation to helping students learn.
V. Voluntary Participation and Withdrawal

Participation in research is voluntary. You do not have to be in this study. If you decide to participate in the study and change your mind, you have the right to withdraw at any time. You have the right to answer only the questions with which you feel comfortable and may choose not to answer questions or stop participating at any time. If you choose not to participate, there will be no negative job repercussions.

VI. Confidentiality:

All information you share will be kept private. Although all participants in the focus groups will be asked to keep all comments confidential, be aware there are limits to the degree confidentiality can be assured by research personnel with information shared during focus groups. The original audio recordings will be kept in a locked filing cabinet in the student investigator’s home for three months after the focus group for transcription. At the end of three months, the audio recordings will be erased and destroyed. Only the student investigator will listen to the audio recordings. Your names will be masked by using terms such as Speaker 1, Speaker 2, etc. A signed consent form with your name will be kept separately in a locked filing cabinet in the office of the student investigator. Only the principal investigator, Jami Berry, and the student investigator, Rhonda Hawkins, will have access to the information you provide. Information may also be shared with those who make sure the study is done correctly (GSU Institutional Review Board and the Office for Human Research Protection (OHRP). The data will be kept for one year after completion of the study before being destroyed.
VII. Contact Persons:

Contact Dr. Jami Berry at 404-4413-8258 or jberry2@gsu.edu or Mrs. Rhonda B. Hawkins at 770-243-2315 or rhhawkins@greateratlantachristian.org if you have questions, concerns, or complaints about this study. You can also call if you think you have been harmed by the study. Call Susan Vogtner in the Georgia State University Office of Research Integrity at 404-413-3513 or svogtner1@gsu.edu if you want to talk to someone who is not part of the study team. You can talk about questions, concerns, or suggestions about the study. You can also call Susan Vogtner if you have questions or concerns about your rights in this study.

VIII. Copy of Consent Form to Subject:

We will give you a copy of this consent form to keep.

If you are willing to volunteer for this research, participate in a focus group and be audio recorded, please sign below.

______________________________________________________   Date__________
Participant

______________________________________________________   Date __________
Principal Investigator or Researcher Obtaining Consent
Appendix G

Writing Sample

Third Grade Girl – Arrowsmith student

Once upon a time there was a princess and her pup named Mia. She was the cutest dog in the world. The princess’s name was Jenna. Mia and Jenna were best best friends.

Mia used to sleep on her bed. She sleeps on Jenna’s bed. They eat breakfast together. They even eat the same thing. Pancakes and fruit. They wear the same thing. Mia wears a purple sparkly dress. Her dress has a fancy diamond necklace. Jenna wears a diamond collar.

Everyone thinks that Mia and Jenna are so cute together. Mia’s leash is purple. With dog paws that are real diamonds. But when the princesses is gone Mia is so so so so so so sad. But when Jenna doing friend and they try to pet her Mia goes. Mia is trying to protect Jenna.
Appendix H

Writing Sample

Third Grade Girl – Arrowsmith student

Once upon there was a girl that wanted to be in the olympics. She was a good swimmer and good at gymnastics. She had to pick one. She didn’t know which one to pick. She really likes swimming, but she’s also really good at gymnastics. She just can’t decide. By the way, her name is Peanut. Peanut needs to decide soon. It’s so hard for her. She’s thinking and thinking. I think it will be gymnastics. It’s really fun. Drum roll please. It’s gymnastics. Yah, I’m so happy. I’m starting in three weeks. I’m so happy. Today I have practice. It will be so much fun.
Appendix I

Writing Sample

Third Grade Boy – Arrowsmith student

these past four to three weeks we had lax pratice and tomorrow in our first lax game and I punt for the game and we are going ugiest pitch right and we’re going to crush them. My dad is the catcher. Last year we were one game away from the chapuvin ship but this year we are going to win the chapuvinship because we are the sartinss!!!! today we got our jurses. I played lucros for four year and every year I was nuder fire for my jurses.
Appendix J

Writing Sample

Third Grade Boy – NonArrowsmith

I like to do sports. The sports I do is lax, baseball, flag football, soccer. I did basketball for one year. I like to play Xbox and Wii. In my family is my dad, mom, brother, me, my sister, dog, and three fishes. I like art and craft. I like oceans and animals very much. I like to climb trees. I liked to sled and have a snow ball fight in the snow.
Appendix K

Writing Sample

Third Grade Boy – NonArrowsmith

What I like about Feiday
is the tugawary soccerkick
and wader bulon. Some times
I get really hot, I have to
put water on me. I play
with my best friends.
Appendix L

Writing Sample

Third Grade Girl – NonArrowsmith

I like field day
because there
were a lot of fun
games. Field day
was yesterday at school.
I like field day
because there were
a lot of games.
# Appendix M

## Arrowsmith Program®

### Chart of Learning Dysfunctions and Learning Outcomes

<table>
<thead>
<tr>
<th>Cognitive Area</th>
<th>Description of Cognitive Function</th>
<th>Common Features if there is a Problem in this Area</th>
<th>Learning Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor Symbol Sequencing</td>
<td>Ability to learn and produce a written sequence of symbols</td>
<td>Messy handwriting, miscopying, irregular spelling, speech rambling, careless written errors in mathematics, poor written performance</td>
<td>Improve handwriting; reduce careless errors in written work; develop fine motor skills, sequential motor memory and motor planning in writing, capacity for hand-eye coordination</td>
</tr>
<tr>
<td>Symbol Relations</td>
<td>Ability to understand the relationships among two or more ideas or concepts</td>
<td>Difficulty with reading comprehension, trouble with mathematical reasoning, trouble with logical reasoning, difficulty reading an analog clock, problem understanding cause and effect, reversals of &quot;b&quot;-&quot;d&quot;, &quot;p&quot;-&quot;q&quot; (younger students and in more severe cases)</td>
<td>Develop ability to read a clock; improve capacity necessary for understanding relationships between concepts necessary for logical and mathematical reasoning and reading comprehension that affect all aspects of curriculum and life</td>
</tr>
<tr>
<td>Memory for Information/Instructions</td>
<td>Ability to remember chunks of auditory information</td>
<td>Trouble remembering oral instructions, difficulty following lectures or extended conversations, problem acquiring information through listening</td>
<td>Develop auditory memory and the capacity to remember and follow oral instructions and retain information for learning; improve the capacity to remember chunks of information</td>
</tr>
<tr>
<td>Predicative Speech</td>
<td>Ability to see how words and numbers interconnect sequentially into fluent sentences and procedures</td>
<td>Problem putting information into one's own words, speaking in incomplete sentences, difficulty using internal speech to work out consequences, trouble following long sentences, breakdown of steps in mathematical procedures</td>
<td>Improve the capacity to understand a sentence of increasing difficulty and length; improve the ability to put information into own words; develop the capacity for the sense of how symbols (words and numbers) interconnect sequentially; improve the ability to follow procedures in mathematics; develop the ability to write and speak in complete sentences</td>
</tr>
<tr>
<td>Broca's Speech Pronunciation</td>
<td>Ability to learn to pronounce syllables and then integrate them into the stable and consistent pronunciation of a word</td>
<td>Mispronouncing words, avoiding using words because of uncertainty of pronunciation, limited ability to learn and use phonics, difficulty learning foreign languages, difficulty thinking and talking at the same time, flat and monotone speech with lack of rhythm and intonation</td>
<td>Develop/improve the capacity for sound-symbol correspondence; develop the phonemic memory necessary for the phonetic aspect of reading; develop the ability to pronounce multisyllabic words correctly; develop the ability to read with greater oral expression</td>
</tr>
<tr>
<td>Cognitive Area</td>
<td>Description of Cognitive Function</td>
<td>Common Features if there is a Problem in this Area</td>
<td>Learning Outcomes</td>
</tr>
<tr>
<td>------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Symbolic Thinking</td>
<td>Ability to develop and maintain plans and strategies through the use of language</td>
<td>Problem being self-directed and self-organized in learning, limited mental initiative, difficulty keeping attention relevantly oriented to the demands of a task necessary for completion, difficulty thinking, planning, problem solving, trouble seeing the main point</td>
<td>Develop/improve the ability to grasp the main point of written or orally presented material; develop the ability to state the main idea of a selection using one's own words; develop the ability to maintain plans and strategies for problem solving; develop the capacity to express ideas more clearly in writing; develop the capacity to self-direct, to develop initiative and to remain focused on tasks to completion</td>
</tr>
<tr>
<td>Symbol Recognition</td>
<td>Ability to visually recognize and remember a word or symbol</td>
<td>Poor word recognition, slow reading, difficulty with spelling, trouble remembering symbol patterns such as mathematical or chemical equations</td>
<td>Develop/improve the capacity to visually recognize and remember words or symbols necessary for reading, spelling and mathematics</td>
</tr>
<tr>
<td>Lexical Memory</td>
<td>Ability to remember several unrelated words</td>
<td>Problems with associative memory, trouble following auditory information, trouble learning names of things such as animals, places, people, colors, days of the week</td>
<td>Improve vocabulary development and auditory memory for words</td>
</tr>
<tr>
<td>Artifactual Thinking</td>
<td>Ability to register and interpret non-verbal information and plan and problem solve non-verbally</td>
<td>Problems interpreting non-verbal information such as body language, facial expression and voice tone, weak social skills, difficulty perceiving and interpreting one's own emotions, difficulty thinking, planning, problem solving non-verbally</td>
<td>Develop the capacity for non-verbal thinking and problem-solving; develop the ability to interpret body language, facial expression and voice tone and to respond appropriately in interpersonal interactions; develop ability to interpret and modulate his/her own emotions</td>
</tr>
<tr>
<td>Supplementary Motor</td>
<td>Ability to carry out internal sequential mental operations, such as mental mathematics</td>
<td>Finger counting, trouble retaining numbers in one's head, difficulty making change, problem learning math facts, poor sense of time management, difficulty with time signature in music</td>
<td>Develop the capacity for number sense; develop the capacity for carrying out internal sequential, mental computation of addition and subtraction; develop the ability to use time wisely through scheduling and organization; develop an understanding of quantification related to money, time, space</td>
</tr>
</tbody>
</table>
Appendix N

Parental Permission Form

Georgia State University
Department of Educational Policy Studies

Parental Permission Form

A Comprehensive Examination of the Arrowsmith Program

At One Private School in Atlanta

Principal Investigator: Dr. Jami Berry
Student Investigator: Mrs. Rhonda B. Hawkins

I. Purpose:

Your child is being invited to be in a research study. The purpose of this study is to evaluate the effectiveness of the Arrowsmith Program.

II. Procedures:
If you give permission for your child to be in the study, your child will be asked to take an anonymous 20-minute survey via SurveyMonkey in the computer lab at school or from his/her own personal laptop. In addition, your child’s pre and post test scores from the Arrowsmith Assessment and from IOWA tests will be used. Your child’s name will not be connected to the scores. There is no cost to be in this study. Your child will not be paid.

III. Risks

In this study, your child will not have any more risks than he/she would in a normal day.

IV. Benefits

Being in this study will give insight into the effectiveness of the Arrowsmith Program. Your child’s input will help other parents and students who consider enrolling in an Arrowsmith Program in the future. This study will also provide information to schools that are thinking about beginning the Arrowsmith Program.

V. Voluntary Participation and Withdrawal

Being in research is voluntary. Your child does not have to be in this study. Your child has the right to drop out at any time. Your child has the right to answer only the questions with which he/she feels comfortable and may choose not to answer questions.
VI. Confidentiality:

Your child’s name will not be on the survey. The student investigator will not know who has completed the survey. Your child’s name will not be connected to the test scores. A number will be assigned to the scores provided by the school administrative assistant not associated with this study. Only the student principal investigator and the principal investigator will have access to the information your child provides. Information may also be shared with those who make sure the study is done correctly (GSU Institutional Review Board and the Office for Human Research Protection (OHRP). The data will be kept for one year after completion of the study before being destroyed. The information on the survey is in no way linked to your child.

VII. Contact Persons:

Contact Dr. Jami Berry at 404-4413-8258 or jberry2@gsu.edu or Mrs. Rhonda B. Hawkins at 770-243-2315 or rhhawkins@greateratlantachristian.org if you have questions, concerns, or complaints about this study. You can also call if you think you have been harmed by the study. Call Susan Vogtner in the Georgia State University Office of Research Integrity at 404-413-3513 or svogtner1@gsu.edu if you want to talk to someone who is not part of the study team. You can talk about questions, concerns, or suggestions about the study. You can also call Susan Vogtner if you have questions or concerns about your rights in this study.

VIII. Copy of Consent Form to Subject:
We will give you a copy of this parental permission form to keep.

If you agree for your child to participate in this research, please sign below.

___________________________________________       Date ____________
Parent or Guardian

_______________________________________________     Date ______________
Principal Investigator or Researcher Obtaining Consent