His and Her Brains?

Effectively Educating Our Boys:

A Meta-Synthesis

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Abstract

The statistical data from the U.S. Department of Education shows a decline in the performance and graduation rates for boys since 1967. By contrast, performance and graduation rates for girls has steadily increased and actually passed the boys in 1981. As reading scores for boys with disabilities continues to be among the lowest in the nation, girls are becoming more competitive in math, science, and AP courses. As this trend has continued in these opposing directions for some time, it has come to the attention of administrators, educators, and even reporters when more schools fail to make adequate yearly progress towards student performance measurements. This meta-synthesis of the literature on the academic achievement of boys as compared to girls examines the effectiveness of brain-based instruction and what impact it has on those outcomes.

1. Introduction

1.1. Background

The changes in American culture have driven changes in educational law and classroom instruction for children across the nation in incremental steps as parents advocated for their children to have access to an equal, free, and appropriate education. From the Civil Rights movement of the 1950s and 1960s, to the monumental piece of legislation accomplished with the passage of The Education Amendments Act of 1972. Included in this act was the portion identified as Title IX, which states that "No person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance." This legislation provided more opportunities and access for females in educational programs and sports equal to male students, especially in secondary schools and institutions of higher education (U.S. Department of Education, 2010).

Just three years after this landmark anti-discrimination law was passed, President Gerald Ford signed into law what has come to be known as the Individuals with Disabilities Education Act (IDEA) (Public Law 94-142) and paved the way for all children to receive a free and appropriate education (FAPE) and related services in schools with their non-handicapped peers. Today, more than 6.9 million children with disabilities have access to a free and appropriate education through individualized education plans supported by special education programs and related services in all 50 states (U.S. Department of Education, 2014).

In order to close what was termed the “gender gap” in academic achievement so that girls were performing equal to their male counterparts in math and science, there has been much research and advocacy promoting the cause of girls in the STEM (science, technology, engineering, and mathematics) courses. And that gap closed at a fairly rapid rate; however, as female students caught up and even surpassed the male students of the same age and grade, a surprising trend emerged. Male performance across all age groups and demographics was declining (Gurian, 2017; Gurian & Stevens, 2005; Kleinfeld, 1998; Pollack, 2000; Sax, 2016; U.S. Department of Education; Warren, 2013; Whitmire, 2010). This downward trend has become so dramatic that researchers and advocates for male students are looking for answers to what many have termed the “boy crisis”.

In the 1990s, the ratio of males to females receiving special education services varied from 2:1 – 3:1. There began to be some concern that there was higher incidence of evaluation referral rates for boys due more to maladaptive classroom behaviors that teachers found difficult to manage, but perhaps did not reflect a true disability (Coleman, 2001; Donovan & Cross, 2002; Fairclough, Toldson, & Lucio, 2014; Farrell & Gray, 2018). Researchers have examined a host of variables ranging from race, teacher opinion and attitude, to socio-economic demographics and varying adverse childhood experiences (ACEs) in order to determine the cause of the variance in referral rates (Beaman, Wheldall, & Kemp, 2006; Healy, 2010; Oswarld, Best, & Coutinho, 2006). And this emphasis on a boy crisis has also generated a rebuttal that this is merely an attempt to diminish the opportunities of girls, but this met with strong rebuttal from researchers, medical professionals, psychologists, and even reporters (Eliot, 2011, Farrell & Gray, 2018; Gurian, 2018; Kleinfeld, 1998; Pollack, 2000; Sax, 2016; Sommers, 2000; Whitmire, 2010).

What happened in 1966 that a dip in the academic performance of boys became a downhill slide? What was the basis of this vast difference in performance between male and female students over the course of K-12 education? With a history of advocating for equal access, equal rights, and a free and appropriate education, was something missed or overlooked with regards to the needs of boys? Or, had something changed in the American educational system and pedagogy that was not meeting their particular academic needs? As administrators and teachers seek to bring up scores of these low-performing students on standardized assessments, they have experimented with single-sex classrooms and implemented other various methods in an attempt to see improvement (Barton, 1988; Blinkhorn, 2009; Canada, 2012; Carrier, 2009; Doren, Murray, & Gau, 2014; Gibson & Cartledge, 2012; Hart, 2015; Piechura-Couture, Heins, & Tchenor, 2011; Spielhagen, 2011; Younger & Warrington, 2002).

According to a report published by the White House Coalition for Men and Boys, this boy crisis extends beyond the classroom and affects a wide range of issues for males including resiliency, social emotional well-being, physical and mental health, suicide, completion of higher education degrees, the ability to establish and maintain stable relationships, marriage, and employment, and even the likelihood of prison time (Farrell & Gray, 2018; Gurian & Stevens, 2005; Kleinfeld, 1998; Pollack, 2000; Sax, 2016; Sommers, 2000; Warren, 2013; Whitmire, 2010). This spectrum of issues spans the male lifetime beyond the range of an educator's reach; however, the effect of a quality teacher or mentor early in a student's educational years can have a lifetime of positive impact. Some of the proponents for addressing this boy crisis claim that it is a matter of brain differences and that the educational system is not adequately differentiating or teaching to boys in the manner in which their brain learns (Gurian & Stevens, 2005; Sax, 2016; Sommers, 2000; Whitmire, 2010). And still others cite numerous other non-academic variables that are contributing to this issue with boys (Coleman, 2001; Doren, et al, 2014; Elliott, DiPerna, Mroch, & Lang, 2004; Farrell & Gray, 2018; Gurian & Stevens, 2005; Kleinfeld, 1998; Pollack, 2000; Sax, 2016; Sommers, 2000; Warren, 2013; Whitmire, 2010.) Despite these criticisms, statistical trends, and rising questions about the underachievement of boys, particularly those with learning disabilities, there have been little if any, specific dissemination of information, guidance, or directives to trickle down to the classroom level.

1.2. Author's beliefs and experiences

For the purpose of this paper it is necessary to define this author's personal bias and beliefs. Neither myself nor my five siblings, nor my children had physical disabilities; neither were any identified as having any learning disabilities. My interests have always been towards academics, to discover what works in a given situation, and how best to enhance or improve the process.

I began my teaching career at a large high school in a suburban Alaskan school district where I taught language arts to students with a wide range of abilities. I was periodically requested to attend the annual meetings for students with IEPs however, I had no deep understanding of what the process actually comprised or accomplished. Our school administration encouraged professional development and I participated in a number of courses and FLTs (focused-learning teams) where we studied topics such as literacy, school climate and culture, and differentiated instruction, to name a few. I was always searching for new strategies or understanding that would equip me to be a better teacher and help my students achieve more.

The next fall my assigned course load included two classes of students who I now realize must have been "far below proficient" on the annual state achievement test. All but one or two in each class had IEPs but since I was not a special education teacher, I felt ill-equipped to meet their unique learning needs. This group did not come with an instruction manual or even a teacher's annotated text; I was not given any instructions, data, or even suggestions for strategies with which to help these struggling readers. I had not yet heard of "brain-based" learning but I utilized strategies learned from a course on differentiated instruction in order to provide some choice and variety of assessment. One mother reported enthusiastically that her 16 year old son told her that this was "probably the first English class I don't hate."

Since transitioning to special education, I have learned more ways to make curriculum accessible for students with exceptionalities; I have been introduced to the work of Spencer Kagan and his classroom structures for enhancing learning through "brain-friendly" cooperative learning activities. Additionally, Temple Grandin was an inspiration; in her book, *The Autistic Brain,* she recounted her personal struggles to learn as she worked to identify how her brain perceived information and then she began to work in harmony with those learning differences. As an English teacher in a resource class for Tier III reading intervention (MTSS-multi-tiered system of support) I have access to various pieces of data and information about the students assigned to my classes—from evaluations such as the Wechsler Individual Achievement Test–Third Edition (WIAT-III) or the Wechsler Intelligence Scale for Children-Fifth Edition (WISC-V), district reading and math assessments, state testing, and curriculum-based assessments from past and present teachers. At times, it still doesn't feel like enough information to identify what they each need.

Last year at an education conference in the Southeastern United States, I attended a panel discussion that was focused on changing the learning trajectory for poorly achieving students, namely African-American boys, but more broadly, male students as an entire demographic.

Members of the panel included principals, a school counselor, a district social worker, and a psychologist and family therapist. As each of the panelists shared, they discussed the links between emotional development, poverty, neglect, and family structure, and how these variables can impact school performance, classroom behavior and discipline issues, and drop-out rates. The questions from the audience reflected similar cases of male academic underachievement from Missouri, Texas, New York, New Jersey, the Carolinas, Mississippi, Alabama, and Georgia. The educational performance of boys across America was pretty grim.

Lastly, psychologist and family therapist, Dr. Michael Gurian shared information regarding the differences between the male and the female brain pertaining to physical structure and the timeline of development, including emotions, language and speech, and problem-solving and decision-making ability. The big picture painted by the panel was that statistics from the U.S. Department of Education revealed a decline in male academic achievement that extended into college. The decline had begun in 1966 and by 1981, female students caught up to their male peers and now exceeded male students in high school graduation rates, college enrollment, and number of college and professional degrees completed. The perspective of these professionals was that these physiological differences and non-academic variables were the impetus behind the higher rate of special education referrals for boys, particularly African-American boys.

This new information about brain differences was very intriguing, but I wanted to know more. In my resource classroom, the ratio of boys to girls the year prior had been approximately 9:1; this year it varied between 7:1 and 5:1. I went away from the conference session with the determination to find answers to improve my practice and improve the academic achievement for the students in my resource classroom.

While most students with exceptionalities look and act like their typically-developing peers, the fact is that they do not learn the same. This is the whole purpose for the Individuals with Disabilities Education Act (IDEA). These students were referred for evaluation and identified as eligible for special education services due to a need or deficit in their ability to perform at a level similar to their peer group. But the heart of the IDEA law is that students with disabilities receive a free and *appropriate* education (FAPE). Would this concept of brain differences affect the appropriateness of special education for male students with disabilities? With this meta-synthesis I plan to investigate the following research questions:

1. What does the research literature reveal about how developmental brain differences affect the way in which male and female students learn?
2. Are there instructional strategies shown to be more effective for the academic achievement of male students?
3. Does the research demonstrate the versatility of “brain-based” instructional strategies across all settings and ability levels – for students with and without learning disabilities in both special education, general education, and inclusive classrooms?

1.3. Purpose of this meta-synthesis

This meta-synthesis, which focuses on the efficacy of brain-based instruction for boys with learning disabilities, has multiple purposes. The first purpose is to review journal articles related to brain-based instructional methods and strategies to evaluate if there has been any proven difference in efficacy by gender. Due to the decremental trend of underachievement for boys, I was also looking for articles that specifically addressed the learning needs of boys with learning disabilities. A third purpose was to classify each article by publication type, to identify the research design, participants, and data sources of each research study, and to summarize the findings of each study. The final purpose in conducting this meta-synthesis was to identify significant themes in the articles in order to connect them to my classroom experience of teaching a diverse population of high school students with special education needs in an urban Alaskan school district.

2. Methods

2.1. Selection criteria

The 48 articles included in this meta-synthesis met the following selection criteria.

1. The articles explored issues related to the academic achievement of boys with disabilities.
2. The articles explored issues related to differences in academic performance outcomes of girls versus boys.
3. The articles explored issues related to performance outcomes of brain-based instruction.
4. The articles were published in peer-reviewed journals, professional journals, and online related to the field of brain-based education.
5. The articles were published between 1988 and 2018.

2.2. Search procedures

Database searches and ancestral searches were conducted to locate articles for this meta-synthesis.

2.2.1 Database searches

I conducted systematic searches within three databases which included: (a) Education Resources Information Center (ERIC, Ebscohost); (b) Education Database (ProQuest); (c) Google Scholar. I used the following search term combinations to conduct Boolean searches of each database:

1. (“brain-based instruction”) AND (“boys with disabilities”).
2. (“students with disabilities”) AND (“academic achievement”) AND (“boys”)
3. (“students with disabilities”) AND (“brain-based learing”) AND (“boys”)
4. (“instructional strategies”) AND (“gender differences”) AND (“brain”)
5. (“brain-based instruction”) AND (“males”) OR (“boys”)
6. (“effective instructional strategies”) AND (“males”) OR (“boys”)

These database searches yielded a total of 43 articles (Alferrink and Farmer-Dougan, 2010; Anfara & Mertens, 2008; Banikowski & Mehring, 1999; Barton, 1988; Beaman, Wheldall, & Kemp, 2006; Blinkhorn, 2009; Bonomo, 2010; Busso & Pollack, 2015; Canada, 2012; Carrier, 2009; Coleman, 2001; Connell, 2009; Doren, Murray, & Gau, 2014; Eliot, 2013; Elliott, DiPerna, Mroch, & Lang, 2004; Fairclough, Toldson, & Lucio, 2014; Gibson & Cartledge, 2012; Gruart, 2014; Hardiman, 2001; Hart, 2015; Jantz & Plotts, 2014; King & Gurian, 2006; Kleinfeld, 1998; Konecki & Schiller, 2003; Landrum & McDuffie, 2010; Laxman & Chin, 2010; Leutwyler, 2007; Masson & Foisy, 2014; Oswald, Best, & Coutinho, 2006; Pagnani, 2013; Piechurra-Courture, Heins, & Tichenor, 2011; Powell, 2018; Reichert, 2016; Saleh, 2011; Senn, 2012, Spielhagen, 2011; Taylor, 2014; Taylor & Lorimer, 2002; Warren, 2013; Whitehead, 2011; Winters, 2001; Wolfe, 2010; Wood & Jocius, 2013).

2.2.2 Ancestral searches

An ancestral search involves reviewing the reference lists of previously published works to locate literature relevant to one's topic of interest (Welch, Brownell, & Sheridan, 1999). I conducted ancestral searches using the reference lists of the previously retrieved articles and the search yielded five additional articles that met the selection criteria (Caine & Caine, 1990; Clement & Lovat, 2012; Geake & Cooper, 2003; Radin, 2009; Younger & Warrington, 2002)

2.3. Coding procedures

I used a coding form to categorize the information presented in each of the 44 articles. This coding form was based on: (a) publication type; (b) research design; (c) participants; (d) data sources; and (e) findings of the studies.

2.3.1. Publication type

Each journal article was evaluated and classified according to publication type (e.g., research study, theoretical work, descriptive work, opinion piece/position paper, guide, annotated bibliography, review of the literature). *Research studies* use a formal research design to gather and/or analyze quantitative and/or qualitative data. *Theoretical works* use existing literature to analyze, expand, or further define a specific philosophical and/or theoretical assumption. *Descriptive works* describe phenomena and experiences, but do not disclose particular methods for attaining data. *Opinion pieces/position papers* explain, justify, or recommend a particular course of action based on the author's opinions and/or beliefs. *Guides* give instructions or advice explaining how practitioners might implement a particular agenda. An *annotated bibliography* is a list of cited works on a particular topic, followed by a descriptive paragraph describing, evaluating, or critiquing the source. *Reviews of the literature* critically analyze the published literature on a topic through summary, classification, and comparison (Table 1).

2.3.2. Research design

Each empirical study was further classified by research design (i.e., quantitative, qualitative, mixed methods research). *Quantitative* research utilizes numbers to convey information. Instead of numbers, *qualitative* research uses language to explore issues and phenomena, and to tell people's stories. *Mixed methods* research involves the use of both quantitative and qualitative methods to present information within a single study.

2.3.3. Participants, data sources, and findings

I identified the participants in each study (e.g. students receiving instruction utilizing brain-based strategies, students receiving traditional instruction, students in single-gender classes, students in mixed-gender classes, teachers in single-gender classrooms. I also identified the data sources that were analyzed for each study (e.g., standardized tests, national longitudinal data, surveys, observations, interviews) Finally, I summarized the findings of each study (Table 2).

2.4. Data analysis

I used a modified version of the Stevick-Colaizzi-Keen method previously employed by Duke (2011) and Duke and Ward (2009) to analyze the 48 articles included in this meta-synthesis. Significant statements were first identified within each article. For the purpose of this meta-synthesis, significant statements were identified as statements that addressed issues related to: (a) addressing the academic needs of boys with disabilities; (b) alternate approaches or methods to achieving academic progress for boys; (c) outcomes by gender following use of brain-based instructional strategies; (d) gender-based classrooms and instruction; (e) teachers' perspectives on gender-based education; (f) scientific support for brain-based education. I then generated a list of non-repetitive, non-overlapping (verbatim) significant statements with (paraphrased) formulated meanings. These formulated meanings represented my interpretation of each significant statement. Lastly, I grouped the formulated meanings from all 49 articles in theme clusters (or emergent themes). These emergent themes represented the essence or content of the entire body of literature (Table 3).

3. Results

3.1. Publication type

I located 48 articles that met my selection criteria. The publication type of each article is located in Table 1. Twenty of the 48 articles (41.7%) included in this meta-synthesis were research studies (Barton, 1988; Blinkhorn, 2009; Canada, 2012; Carrier, 2009; Coleman, 2001; Doren et al., 2014; Elliott et al., 2004; Fairclough et al., 2014; Gibson & Cartledge, 2012; Hart, 2015; Leutwyler, 2007; Oswald et al., 2006; Piechurra-Couture et al., 2011; Powell, 2018; Radin, 2009; Saleh, 2011; Spielhagen, 2011; Taylor, 2014; Warren, 2013). Twelve of the articles (25%) were theoretical works (Alferrink & Farmer-Dougan, 2010; Beaman et al., 2006; Busso & Pollack, 2015; Clement & Lovat, 2012; Eliot, 2013; Geake & Cooper, 2003; Gruart, 2014; Jantz & Plotts, 2014; Kleinfeld, 1998; Landrum & McDuffie, 2010; Masson & Foisy, 2014; Winters, 2001). Eight of the articles (16.7%) were guides (Banikowski & Mehring, 1999; Connell, 2009; King & Gurian, 2006; Reichert, 2016; Senn, 2012; Taylor & Lorimer, 2002; Wolfe, 2010; Wood & Jocius, 2013). Four of the articles (8.3%) were descriptive works (Bonomo, 2010; Caine & Caine, 1990; Hardiman, 2001; Konecki & Schiller, 2003). Three of the articles (6.3%) were reviews of literature (Anfara & Mertens, 2008; Laxman & Chin, 2010; Pagnani, 2013). One article (2%) was an opinion piece (Whitehead, 2011).

Table 1

Author(s) & Year of Publication	Publication Type
Alferrink and Farmer-Dougan, 2010	Theoretical Work
Anfara and Mertens, 2008	Review of Literature
Banikowski and Mehring, 1999	Guide
Barton, 1988	Research Study
Beaman, Wheldall, and Kemp, 2006	Theoretical Work
Blinkhorn, 2009	Research Study
Bonomo, 2010	Descriptive Work
Busso and Pollack, 2015	Theoretical Work
Caine and Caine, 1990	Descriptive Work
Canada, 2012	Research Study
Carrier, 2009	Research Study
Clement and Lovat, 2012	Theoretical Work
Coleman, 2001	Research Study
Connell, 2009	Guide
Doren, Murray, and Gau, 2014	Research Study
Eliot, 2013	Theoretical Work
Elliott, DiPerna, Mroch, and Lang, 2004	Research Study
Fairclough, Toldson, and Lucio,	Research Study
Geake and Cooper, 2003	Theoretical Work
Gibson and Cartledge, 2012	Research Study
Gruart, 2014	Theoretical Work
Hardiman, 2001	Descriptive Work
Hart, 2015	Research Study
Jantz and Plotts, 2014	Theoretical Work
King and Gurian, 2006	Guide
Kleinfeld, 1998	Theoretical Work
Konecki and Schiller, 2003	Descriptive Work
Landrum and McDuffie, 2010	Theoretical Work

Laxman and Chin, 2010	Review of Literature
Leutwyler, 2007	Research Study
Masson and Foisy, 2014	Theoretical Work
Oswald, Best, and Coutinho, 2006	Research Study
Pagnani, 2013	Review of Literature
Piechura-Couture, Heins, and Tichenor, 2011	Research Study
Powell, 2018	Research Study
Radin, 2009	Research Study
Reichert, 2016	Guide
Saleh, 2011	Research Study
Senn, 2012	Guide
Spielhagen, 2011	Research Study
Taylor, 2014	Research Study
Taylor and Lorimer, 2002	Guide
Warren, 2013	Research Study
Whitehead, 2011	Opinion Piece
Winters, 2001	Theoretical Work
Wolfe, 2010	Guide
Wood and Jocius, 2013	Guide
Younger and Warrington, 2002	Research Study

3.2. Research design, participants, data sources, and findings of the studies

As stated previously, I located 20 research studies that met my selection criteria (Barton, 1988; Blinkhorn, 2009; Canada, 2012; Carrier, 2009; Coleman, 2001; Doren et al., 2014; Elliott et al., 2004; Fairclough et al., 2014; Gibson & Cartledge, 2012; Hart, 2015; Leutwyler, 2007; Oswald et al., 2006; Piechurra-Couture et al., 2011; Powell, 2018; Radin, 2009; Saleh, 2011; Spielhagen, 2011; Taylor, 2014; Warren, 2013). The research design, participants, data sources, and findings of each of these studies are identified in Table 2.

Table 2

Authors	Research Design	Participants	Data Sources	Findings
Barton, 1988	Quantitative	96 Male students, 8-13 years old. Included students in general education and special education.	A stimulus array for the 20-Questions Game	This study examined if boys with disabilities would be able to learn a meta-cognitive questioning strategy to the same degree as their non-disabled peers. The study also was measuring for transfer and retention. All boys improved after the training, though the younger boys with disabilities were less skilled at asking questions that led to problem-solving than their peers without disabilities.
Blinkhorn, 2009	Quantitative	88 Students in grades 9-11 from a southern suburban school district at a Title I high school. Included students in general education, students identified as at-risk, and students with disabilities (SWD).	Online version of the end-of-course-test (EOCT) as a pre-test and post test	This study examined the effectiveness of a multi-modal multisensory instructional strategy in biology and history classes. The study examined outcomes for students with and without disabilities as well as those identified as "at-risk". The students without disabilities in the experimental group performed comparable to their peers in the control group. The SWD demonstrated more gains on the post-test than their control group peers and more than either group of at-risk students. The students who received the training in the biology class demonstrated the greatest gains out of all groups.
Canada, 2012	Quantitative	29,523 Middle school students from single-gender and	Student test scores for states	The focus of this study was to make a comparison of state assessment scores between student who had participated

		mixed gender schools in South Carolina	performance assessment	in single-gender classrooms and those in mixed-gender classes. The also examined the comparison of score differences for males and females from the two different settings. The study concluded that there was no significant difference in outcomes between the boys and the girls, nor for the mixed-gender group in comparison to the single-gender group.
Carrier, 2009	Mixed methods	80 Students in grades 4 and 5 from the southeastern United States	Pre-test and post-test using Musser and Malkus's (1994) Children's Attitudes Toward the Environment scale, and a survey.	This study examined the effectiveness of an environmental science lesson taught in the schoolyard with hands-on activities as compared to peers receiving the same lesson through traditional methods in a classroom. The results indicated that boys demonstrated greater growth than the girls in both groups across all four areas: (a) knowledge, (b) attitudes, (c) behaviors, and (d) comfort levels. The girls in the experimental group demonstrated greater gains than the girls in the traditional group in 3 of the 4 areas. The girls in the experimental group demonstrated a decrease in environmental attitudes after treatment than their counterparts in the traditional class.

Coleman, 2001	Qualitative	21 Middle-school boys grades 6-8; all participants were identified as twice exceptional, both with giftedness and a learning disability	Interviews	This study investigated the qualities that were beneficial for academic success for boys who were identified as both gifted and learning disabled. Four major themes emerged for helping boys who were twice exceptional to succeed in school: (a) strategies to cope with their environment, (b) strategies to cope with academic content, (c) strategies for test taking, (d) general strategies for encouragement, attitude, and communication.
Doren, Murray, & Gau, 2014	Quantitative	11,000 students 13-17 years old who were receiving special education services	Data from National Longitudinal Transition Study-2 (NLTS2) including questionnaire, telephone and face-to-face interview with parents, guardians, and students.	This study examined data from the National Longitudinal Study to identify factors that cause students with disabilities to drop out of school. Results revealed the most frequent reasons that SWD dropped out of school was due to poor grades, poor social skills, risk behaviors, and having been arrested. Students were less likely to drop out with improved grades, increased social skills, and increase in getting along with teachers and peers.
Elliott, DiPerna, Mroch, & Lang, 2004	Quantitative	2,060 K-12 students from a national sampling of 80 schools from 30 states; also included 401 teachers	ACES (rating scale to evaluate learners' academic and study skills)	This study focused on identifying the academic and study skills that enable learners to succeed. General education students received higher ratings on academic enablers than (a) students with learning disabilities and (b) at-risk students.

				Females generally received higher ratings than males on academic enablers. Students with disabilities demonstrated higher ratings for academic enablers than the at-risk students.
Fairclough, Toldson, & Lucio, 2014	Qualitative	American Indian, African American, and Latino males with disabilities	U.S. Department of Education data on dropout rates	This extensive longitudinal study examined causes and extent of dropout rates for males across three minority groups. The study included causes, gaps in research, suggestions for interventions and improved practice. Also included were implications for policy changes and school-level changes.
Gibson & Cartledge, 2012	Qualitative	4 first grade African American male students	DIBELS winter and spring benchmark sub-tests; Standard reading passages from first grade AimsWeb (2004)	This case study examined the effectiveness of targeted, direct, explicit instruction for males with significant reading delays. Results indicated that direct instruction in reading fluency were effective individually and in small group setting. Three of the four participants demonstrated significant growth; the fourth demonstrated improvement, but to a lesser degree.
Hart, 2015	Mixed Methods	109 Female sixth grade students in single-sex classrooms in Southeastern United States	Quasi-experimental group comparison, post-test	This study examined academic attitudes and school satisfaction of middle school girls with a comparison between those in single-gender classrooms and those in coeducational classrooms. The girls in the single-gender classrooms expressed more positive attitudes about school than peers in coeducational classrooms.

				The girls in single-gender classrooms demonstrated more intellectual risk-taking behaviors than peers in mixed-gender classrooms, especially in science and math classes.
Leutwyler, 2007	Mixed-Methods	1,432 High school students from 20 high schools in Zurich, Switzerland	Questionnaire	This study analyzed the developmental patterns of high school students over a three-year period to evaluate their self-reported use of three forms of meta-cognitive learning strategies. Female students reported using meta-cognitive strategies more often than males; however, the results did not reveal a significant pattern of growth or development over the course of the three-year study.
Oswald, Best, & Coutinho, 2006	Quantitative	Sample included 1,052 schools for a total sample of 23,926 subjects; Sample included students with and without disabilities.	Sample using the NELS-88 Longitudinal study by National Center for Education Statistics (NCES), surveys, tests	This study examined 10 years of longitudinal data from NCES to determine if there was a pattern of probability for predicting a student identified as special education status. The probability of predicting special education status varied between males and females with regards to a single covariate – self-concept. Across race/ethnicity, black males with the lowest self-concept were more likely to be in special education.
Piechura-Couture, Heins, & Tichenor, 2011	Quantitative	2200 students, 178 parents, 181 teachers from 41 different schools k-12 throughout South Carolina; students included	Voluntary surveys posted on the website of the South Carolina Department of Education	This study focused on attitudes and behavioral outcomes of boys who had participated in single-gender classrooms. Teachers in single-gender classrooms reported

		students with and without disabilities		improvement for boys in three areas: behavior, participation, and attitude toward school. According to student self-reports: boys indicated that they believe they have improved in the areas of focus, grades, and ability to succeed in school; also indicated increased interest in trying new ways to learn. Parents reported grade improvements, son's desire for academic success, and developing autonomy/independence.
Powell, 2018	Quantitative	436 African American male students in grades 10-12 from 5 urban high schools in eastern Virginia	Non-cognitive questionnaire (NCQ)	This study examined seven non-cognitive variates to determine factors that contributed to academic success. Three of the seven noncognitive variables were significantly linked to academic success: (a) leadership experience, (b) realistic self-appraisal, and (c) availability of a strong support person.
Radin, 2009	Qualitative	10 Educational Theorists	Surveys, interviews	This study focused on identifying the qualities and characteristics that are essential for classroom teachers in the modern school. The researchers compiled a list of the top traits from the surveys and interviews: (a) the teacher's adaptability to student learning styles and needs within any given class is most important quality for student achievement; (b) implementation of brain-compatible instruction which includes five

				characteristics of an enriched environment: emotional involvement for both teacher and student; the physical systems of the room; lowered stress and threat levels; variety of experiences in the classroom; challenges, problem-solving, and authentic work. And also concurred that on-going training and professional development in brain science contributes to a more brain-compatible instruction.
Saleh, 2011	Qualitative	100 secondary Malaysian students taking a basic (beginning) Physics course	Pretest /post-test assessments	This study compared the learning outcomes for students who received the physics unit incorporating brain-based teaching strategies to those of the students who were taught with conventional teaching methods. The students in the experimental class demonstrated greater knowledge and understanding of the physics concepts than the students receiving conventional instruction.
Spielhagen, 2011	Mixed-meth ods study	52 teachers in 2 single-sex middle school academies	Focus group interviews, Likert-type initial survey, follow-up survey with open-ended responses	This year-long study examined the effectiveness of single-sex classes from the perspective of the teachers who were hired for positions with this new initiative. In addition to interviews, teachers completed surveys prior to start of classes and then at the end of the school year. Their reports revealed that (a) both boys and girls seemed “comfortable” with the single-sex classrooms; (b) boys and girls do process

				information differently, (c) the single-sex classroom allowed teachers to address learning needs specific to each group, (d) boys are better behaved in a single-sex classes, (e) both genders demonstrated more participation than in co-educational classes, (f) teachers felt it was easier to teach the students, (g) believe that single-sex classes should continue to be an option.
Taylor, 2014	Qualitative Case study	3 teachers and 10 high school students in gender-based reading classes (all boy or all girl)	Parent orientation, classroom observations, student interviews, teacher interviews	This study examined the effectiveness of reading strategies in a single-gender classroom from the perspective of both the teachers and the students. The boys reported that the strategies that had a favorable and positive effect on their learning were: summarizing, chunking, and KWL; they also valued the camaraderie/relationships of the all-male classroom. The girls reported that they also benefitted from the same three strategies; however, the girls expressed frustration over the peer "attitudes" that felt distracting in the all-female classroom. Teachers reported that while the reading materials/selections were gender-specific in the areas of student interest, the actual instructional strategies were not gender-specific. The boys demonstrated increased engagement in lessons and classroom activities, but the girls

				preferred to work quietly and independently.
Warren, 2013	Qualitative	4 white high school teachers from a Midwestern school district within a predominantly black community	semi-structured interview, classroom observations, student surveys; and an interactive narrative between teacher and students	This study examined the benefit of empathy for improving student-teacher interactions between white female teachers and their Black male students. Three themes emerged: safe and trusting teacher-student relationships, increased willingness to take risks and demonstrate flexibility, increased capacity to develop proactive academic interactions
Younger & Warrington, 2002	Mixed-Methods	Students and teachers from a British Comprehensive School (ages 11-16)	12-year Longitudinal data, classroom observations, interviews	Girls reported that the single-gender classroom felt more academically “safe”. Girls’ in single-gender classroom demonstrated greater confidence and self-esteem than female peers in mixed-gender classrooms. Teachers reported less “drama” in single-gender classrooms. Teacher reported increased instructional time and fewer behavior incidents in all-boy classrooms as compared to mixed-gender classrooms. Boys in single-gender classrooms expressed appreciation for relaxed atmosphere and teachers with a sense of humor.

3.2.1. Research design

Eight of the 20 studies (40%) in this meta-synthesis employed a quantitative research design (Barton, 1988; Blinkhorn, 2009; Canada, 2012; Doren et al, 2014; Elliott et al, 2004; Oswald et al, 2006; Piechura et al, 2011; Powell, 2018). Seven of the studies (35%) employed a qualitative research design (Coleman, 2001; Fairclough et al, 2014; Gibson & Cartledge, 2003; Radin, 2009; Saleh, 2011; Taylor, 2014; Warren, 2013). Five of the studies (25%) employed a mixed methods research design, collecting and analyzing a combination of both quantitative (i.e., numerical) and qualitative (i.e., non-numerical) data (Carrier, 2009; Hart, 2015; Leutwyler, 2007; Spielhagen, 2011; Younger & Warrington, 2002).

3.2.2. Participants and data sources

The majority of the 20 studies included in this meta-synthesis analyzed data collected from K-12 students both with and without disabilities. Twelve of the 20 studies (60%) analyzed data collected from K-12 students with disabilities (Barton, 1988; Blinkhorn, 2009; Canada, 2012; Coleman, 2001; Doren et al, 2014; Elliott et al, 2004; Fairclough et al, 2014; Gibson & Cartledge, 2012; Hart, 2015; Oswald et al, 2006; Piechura et al, 2011; Taylor, 2014). Seven of the studies (35%) analyzed data collected from K-12 students who received instruction utilizing brain-based strategies (Barton, 1988; Blinkhorn, 2009; Carrier, 2009; Gibson & Cartledge, 2012; Leutwyler, 2007; Radin, 2009; Saleh, 2011). Six of the studies (30%) analyzed data collected from K-12 students who received instruction in a single-sex (all-male or all-female) classroom (Canada, 2012; Hart, 2015; Piechura et al, 2011; Spielhagen, 2011; Taylor, 2014; Young & Warrington, 2002). In addition to K-12 students with and without disabilities in these various settings, data was also analyzed from other participants. These additional participants included K-12 teachers, college teachers in education programs, and parents.

Surveys, interviews, and test results provided the main data sources used in the research studies. Nine of the studies (45%) used surveys to collect data (Carrier, 2009; Doren et al, 2014; Leutwyler, 2007; Oswald et al, 2006; Piechura et al, 2011; Powell, 2018; Radin, 2009; Spielhagen, 2011; Warren, 2013). Eight of the studies (40%) used data collected from pre-tests/post-tests and state assessments (Barton, 1988; Blinkhorn, 2009; Canada, 2012; Carrier, 2009; Gibson & Cartledge, 2012; Hart, 2015; Oswald et al, 2006; Saleh, 2011). Seven of the studies (35%) used data collected from interviews (Coleman, 2001; Doren et al, 2014; Radin, 2009; Spielhagen, 2011; Taylor, 2014; Warren, 2013; Younger & Warrington, 2002). Other data sources were also used in the research studies, including database analysis, direct observations, and scale-based assessments.

3.2.3. Findings of the studies

1. Academic success for boys- Boys, especially boys with disabilities, are falling further behind girls in reading and math; and, boys with disabilities from culturally and ethnically diverse backgrounds have the lowest reading scores and highest dropout rates. Boys respond well to direct, explicit instruction and opportunity for more kinesthetic activity rather than just sitting down and being quiet; but boys demonstrated fewer academic and study skills that would enable them to achieve academic success. They thrive when they are in an environment where there is a relaxed atmosphere with trust, humor, and someone who helps them organize their time and tasks. There are also key non-cognitive variables which have shown to have significant impact on the academic achievement for boys. A positive self-concept was the number one

non-cognitive factor that affected academic success for Black males, as well as a good relationship with teachers and peers; also, a reliable support person to provide accountability, encouragement, and help with homework.

2. Brain-based instruction – While there were differing results across the various settings and types of strategies used, boys demonstrated the most promising results, even the youngest boys with learning disabilities showed improvement. The studies showed that students in math and science courses benefited from the implementation of brain-based strategies. Education theorists reported that brain-based or brain-compatible instruction includes five characteristics: emotional involvement for both teacher and student; the physical systems of the room, which includes seating arrangements, traffic patterns, lighting, and noise level; lowered stress and threat levels; variety of experiences in the classroom; challenges, problem-solving, and authentic, realistic work. Classroom teachers and college education instructors agree that on-going training and professional development in brain science will facilitate more brain-friendly instruction.

3. Single-sex classrooms – Administrators that recognize that the boys are not experiencing academic success, or districts and schools that have not demonstrated adequate yearly progress (AYP) are trying different methods to improve test scores. Some have implemented district-wide initiatives for single-sex classrooms in an attempt to focus on instruction that may better meet the learning needs of the neediest students. Parents could choose to opt out, but feedback from parents, students, and teachers was largely favorable. Some districts and schools did not see the magnitude of results they had hoped for, but the positive response and recommendations for keeping it as an option may prove beneficial in the long-term. Boys and girls both responded in favor of their experience, were willing to try it again, and felt it

was easier to learn than in a coeducational classroom. Parents reported that their sons had improved grades, but more importantly, they showed improved attitudes towards school and learning. Girls also reported that it felt like a “safe” learning environment; teachers reported that the girls demonstrated greater investment in deeper inquiry in the single-sex environment. Teachers also felt like it was easier to teach in the single-sex environment and they had a lot less classroom drama.

3.3. Emergent themes

Theme Clusters	Formulated Meanings
Academic Underachievement of Boys	● On average, boys are slower to learn to read than girls of the same biological age. ● Boys read less than girls and show less enthusiasm for reading. ● Boys reported that they were 48% more likely to be on the computer than read; 24% more likely to watch TV; 70% more likely to do something physical or be on the computer than spend time reading. ● A boy’s typical criteria for a book was that it was “short”. ● By high school, 50% of boys classify themselves as “non-readers”. ● Boys rank behind girls on all standardized tests. ● Students with LD typically have lower social skills. ● Boys demonstrated fewer academic enabling skills than girls. ● Students with disabilities demonstrated weaker and fewer academic enablers than students without disabilities. ● Boys have lower aspirations for themselves than girls. ● On average, boys expend less energy and effort on academic achievement than girls. ● Boys typically have lower grades than their female peers. ● Boys typically have more discipline referrals. ● Misunderstood development of boys can lead to them being labeled as “lazy”. ● The lowest reading scores in the nation are among Black males in the lowest socio-economic status, and they are at the most risk for dropping out. ● Delayed academic progress is #1 reason for boys being referred for evaluation for special education services. ● Lack of academic progress and behavioral concerns was second most frequent reason for referral.

	● Maladaptive behaviors in Black male students was shown to be a strong indicator of family conflict, much more so than for female students. ● Boys with LD are at greater risk than girls for dropping out of high school. ● Low grades, poor social skills, risk behaviors, and having been arrested are predictors of increased risk for dropping out of high school. ● Twice exceptional boys, those identified as both gifted and with a learning disability, say that they need help coping with content and the process of learning. ● Gifted boys with learning disabilities have a difficult time in environments that are noisy. ● Gifted boys with disabilities frequently struggle with taking tests due to lack of appropriate accommodations in place due to misperceptions about their abilities versus their intelligence.
Brain Differences Between the Sexes	● According to fMRI, boys perform better in spatial attention tasks. ● According to fMRI, girls perform better on word generation tasks and emotive functioning. ● Boys' brains have more cortical areas dedicated to spatial-mechanical functioning. ● On average, boys use half the brain space that females use for verbal-emotive functioning. ● Most boys experience words and feelings differently than girls do. ● Boys have less serotonin and oxytocin than girls, this makes them more prone to be impulsive and restless or fidgeting to fight off “sleep” mode. ● According to neurologists, boys’ brains recharge by going into a “rest state”, typically observed when their eyes droop while they are at the back of a class or by fidgeting restlessly to avoid sleep. ● Boys’ brains are structured to compartmentalize or focus on a single task and have difficulty transitioning quickly from one task, lesson, or class to another. ● With a prefrontal cortex that is more active and develops earlier than in boys’ brains, girls are less likely to make impulsive decisions. ● The corpus callosum is the bundle of tissues connecting the two hemispheres of the brain; it is 25% larger in girls than boys by the time they reach adolescence. ● The larger corpus callosum in girls enables more activity in the language areas of her brain, on average girls are better able to connect words with emotions and articulate what they are feeling.
Single-sex Schools and Classrooms	● Parents and teachers reported improved behaviors for boys participating in single-sex classrooms. ● Parents reported that their sons demonstrated improved attitudes towards school and interest in learning.

	● Teachers reported that it seemed easier to teach the students in a single-sex classroom and provided more opportunity to focus on individual needs. ● Teachers reported that there was less “drama”. ● There were fewer reported incidents of bullying. ● Boys indicated that they were more interested in trying new ways to learn. ● Among middle school students, boys and girls who participated in single-sex classrooms indicated that they enjoyed the experience and wanted to do it again. ● Boys were more focused on learning activities and demonstrated longer spans of time at a task than peers in coeducational classrooms. ● Boys reported that they liked learning with their friends without girl “drama”. ● Middle school girls in single-sex classrooms expressed more positive attitudes about school than their peers in coeducational classrooms. ● Girls reported that the classroom felt more academically “safe”. ● Teachers reported that girls engaged in deeper intellectual risk-taking in math and science classes than had been observed previously in the coeducational classroom. ● Teachers reported that they saw girls grow in confidence and greater self-esteem in the single-sex classroom. ● Students with lower academic abilities showed more significant growth in the single-sex environment versus their peers learning the same material in a coeducational environment.
Planning Effective Instruction to meet the needs of Boys	● Elementary and middle school boys with learning disabilities improved problem-solving abilities when taught questioning techniques alongside non-disabled peers. ● Boys find greater interest in reading when allowed to choose the topic. ● Boys expressed more interest in reading when exposed to culturally relevant reading options, such as race/ethnic identity or social situations. ● Boys expressed greater value for reading when there was opportunity for critical conversations in a safe environment to discuss deeply emotional or sensitive topics. ● Boys’ performance improved when lesson concepts were paired with use of spatial-visual representation and/or manipulatives. ● The use of visual dictionaries and picture charts to illustrate a process were beneficial. ● The use of mnemonic strategies, music, and rap facilitate transference to long-term memory and facilitate recall. ● Boys demonstrate increased engagement when lessons have practical, real-life purpose.

	● Boys demonstrate increased engagement in classroom activity where competition is permitted and/or encouraged. ● Humor and relaxed atmosphere showed positive effect for reducing behavior issues in all-male classrooms. ● Boys benefit when given opportunities for autonomy through self-directed practice and decision-making rather than an entirely autocratic instructional environment. ● Boys respond positively when they have male role models who share about their own writing and reading habits. ● Female teachers who expressed empathy and a non-confrontational approach for establishing rapport with boys reported dramatic decrease in referrals and maladaptive behaviors.
Implications for Connecting the Brain Science to Classroom Instruction and Learning	● Learning engages the whole physiology (body and brain). ● The brainstem and the associated regions are responsible for basic biological functions and reflexes that keep us safe in the presence of threat or danger. ● The brain will “shut down” when threatened, which inhibits learning. ● Stress complicates higher-order thinking skills. ● Chronic stress impairs the brain’s ability to sort and prioritize. ● The limbic system is the portion of the brain associated with emotional response, basic memory and motivation, rich connections to the other regions of the brain. ● Emotions are critical to patterning or making connections with new information. ● Learning is enhanced by challenge. ● The cerebral cortex region is where the brain makes sense of information from the senses, language, conscious behavior, complex memory, judgment, and reasoning. ● Learning involves both focused attention and peripheral perception. ● The brain processes “wholes” and “parts” simultaneously. ● Repetition or exposure to similar information potentially increases development of dendrites. ● Neuroimaging reveals that dendrites are “use it or lose it”; too long between exposure to info often reduces ability to recall (i.e. memory loss). ● Revisiting and repeating information and tasks promote active processing (looping) and foster long-term memory and retrieval. ● When learning a new physical skill, the frontal lobe, the motor cortex, and the cerebellum are all in use (activated) until the skill is mastered then control for the activity shifts to the cerebellum because the skill has become automatic. ● The brain has cycles of learning which, according to the primacy-recency effect, what is taught or discussed during the “prime

	time" or up part of the cycle is what is most easily recalled (as on a test). ● Using multiple modes of input (visual, auditory, kinesthetic) increased students' retention of information and understanding of complex concepts. ● Similar to experiencing violence and trauma, males who were exposed to violent media, games, and TV experienced activity in the brain regions as if they had actually experienced the event. ● Extended and prolonged screen time exposure through the use of smartphones, tablets, computers, and video games contributes to brain damage. ● The brain images of children who had several hours of screen time per day showed structural and functional changes associated with the regions for processing emotions, executive attention, decision-making, impulse control, and moodiness. ● Brain scans reveal that cognitive developmental delays and impairments associated with the neurotoxic effect of alcohol and cannabis use has shown to impair learning, memory, attention, and decision-making. ● The neurotoxic effect of increased cannabis use (without additional alcohol consumption) showed additional deficits in cognitive functions such as perceptual reasoning, memory recall, working memory, and inhibitory control.

4. Discussion

I this section, I summarized the major themes that emerged from my analysis of the 48 articles included in this meta-synthesis. I then connected these emergent themes to my teaching practice as a special education teacher in a resource English class in a Title I school.

4.1. Academic underachievement of boys

A review of the literature and the statistical data clearly revealed that there is a severe decremental trend in the academic performance of boys compared to girls. The percentage of the boys identified with learning disabilities, the lowest reading skills, and overall underachievement, are red flags that any educator would address if these boys were in their classroom; how much more urgent is the need to examine the data more closely in order to formulate a plan for more appropriately meeting the academic needs of boys. It was surprising that I had not previously been aware of this critical state of male underachievement.

I teach reading to high schoolers with reading and writing disabilities, I face these statistics every year; these statistics are right on the other side of my desk. The ratio of boys to girls in my classes ranges from 5:1 to 8:1, so this puts new emphasis on my need for thoroughly researching their records and IEPs to make sure nothing gets missed. Some boys who demonstrate maladaptive behaviors in the classroom, have low or failing grades, and are involved in risky behaviors have at times been an enigma to me.

Now that I have a broader perspective of the severity and extent of this issue, I feel more determined to evaluate the individual academic needs of the boys in my classes in order to increase the possibility for their academic improvement. I must ask more questions of them, of the data, and I cannot wait on a district supervisor or other leader to bring me information. I am their teacher, case manager, advocate—their voice. I must continue to research information in order to ameliorate this negative trend so they are not among those negative statistics.

4.2. Brain differences between the sexes

Despite what some may claim, recent brain images clearly show that there are physical and biological differences between the brains of boys and girls. The advent of fMRI imaging has extended scientists' understanding of which regions of the brain are activated during different types of physical and cognitive activities. The research reveals that the brain is activated in different regions for boys and girls when performing the exact same tasks or cognitive activities. Additionally, the differences in brain chemistry and neurotransmitter uptake between boys and girls could also contribute to differences in how they process information. As the science continues to develop, and the research on brains and brain differences between the sexes continues to unfold, there will be more and more insight to better equip counselors and educators to understand students and the unique abilities, talents, and challenges of both boys and girls in an equitable fashion suitable for each.

After discovering the alarming statistics, the look at the neuroscience that reveals differences between the brains of boys and the brains of girls was highly eye-opening. While the actual science may not have a direct impact on my classroom or practice, the fact that there are physiological and developmental differences that affect maturity, processing speed, communication style and rate, and many other factors, *does* play a role in the educational process in my classroom. Having an awareness of these differences and keeping them in mind during lesson planning, instruction, wait time, or when making accommodations will have an impact on the potential outcome and benefits for both the boys and girls in my classroom. According to the research, even understanding the differences in the circadian rhythms between males and females with regards to biologic age can affect the pacing of instruction over the course of the day. Additionally, as an educator of children with varying exceptionalities, it is vital that I not only understand the different disabilities, but that I continue to pursue understanding of the science of learning and cognition as well.

4.3. Single-sex classrooms and schools

Under the requirements of the *No Child Left Behind* law, schools and districts that have not made AYP have been mandated to develop a plan of improvement. A large portion of the students in those schools and districts are students with disabilities and other at-risk populations. As their Response to Intervention (RTI), a number of districts have added classrooms and programs that provide separate instruction for all boys or all girls. Different locations have experienced different degrees of success. These mixed results do not provide a clear answer as to whether or not single-sex classrooms are an effective solution. If a district is implementing this strategy without thorough planning, that may be why they did not achieve as significant results as they had hoped. Much of the feedback from teachers who had taught in single-sex classrooms expressed the need for ongoing training, timely feedback, and more time for planning in collaboration with their team members. The same needs are frequently expressed by teachers in coeducational classrooms, so the question remains as to why administrators failed to respond to the needs of their teachers.

The response from students who participated in single-sex classrooms was largely positive. Boys and girls alike expressed enjoyment in the environment and felt that there was less drama and conflict to interfere with their learning. Teachers also commented that it was easier to teach to a single gender because drama and discipline problems were significantly reduced. Parents also reported that their boys seemed to enjoy school more, expressed improved attitude towards learning and academic activities. There was a high percentage of boys and girls alike who responded that they would like to continue being in a single-sex classroom again the following year. Parents and teachers both were largely in favor of continuing to keep single-sex classrooms as an option at their school.

A single-sex classroom has not been a part of my practice to date, however there have been a couple of classes over the course of the years where there was only one or two girls on the roster with several boys. There have been a few occasions where the females may have been absent and only boys were present. Due to the nature of a resource classroom and the various disabilities, personalities, and behaviors, any student with a strong personality or maladaptive behavior can disrupt the daily routine; therefore, on a day when that particular student was absent the change is distinctly different. In the wake of learning this new information about the educational needs of boys, I have been curious as to whether or not a classroom with only males would be beneficial at the high school level. The literature that I had read in the course of this meta-synthesis primarily discussed this scenario at the elementary or middle school level.

4.4. Planning effective instruction to meet the needs of boys

When planning effective instruction that meets the academic needs of boys and especially boys with learning disabilities, the research studies identified several key characteristics. Their studies reveal that boys seem more focused during the lesson and demonstrate greater enthusiasm for learning when there is a classroom with a relaxed atmosphere and a touch of humor. This reflects the brain research which has identified that the brain releases chemicals under stress, which inhibit cognitive processes. When boys were in an all-boy classroom, or an environment where competition was permitted or encouraged; they demonstrated greater engagement in the learning activities. They also responded positively when there was realistic, hands-on activities or manipulatives associated with the lesson. In the studies, boys responded well to clear instructions, high expectations, indirect and explicit instruction for using a strategy. Boys reported enjoying an environment that was free of what they termed “girl drama” and demonstrated fewer maladaptive behaviors and a reduced number of discipline referrals. Increased engagement, more interest in learning, and reduced problematic behaviors and referrals— these sound like positive and effective factors that would be appealing to any teacher or administrator for addressing issues with their male students in order to promote academic improvements.

This information has contributed to shift in my perspective and how I can better prepare my lessons to have a greater academic benefit for my male students. It has been a work in progress as I have researched this topic. In addition to this research project of effective instructions for boys, our school also implemented a literacy methodology based on cultivating students' awareness of their own metacognitive process through inquiry, explicit modeling, and academic discussions. The purpose of the literacy framework was to cultivate higher-order thinking and improve reading comprehension. This new methodology paired ideally with the information I had discovered about boys' academic deficits and needs, so I planned the lessons utilizing different strategies from the suggestions in this literature. Cooperative learning is a frequent activity, but not simply just "pair-n-share" but they had increased opportunity for motor activity, competition, and incorporated novelty activities to generate interest through investigation and problem-solving. I staged each lesson as a question, inviting them to help gather data in our "reading lab" to investigate how their brains worked. There was a subtle, yet distinct shift in the dialogue of our classroom from frequent responses of "I don't know" or a shrug, to a becoming a forum for questioning because "it's ok to be confused, for now." Based on the progress they have demonstrated thus far, our classroom is becoming a boy-friendly, enriched learning environment.

4.5. Implications for connecting brain science to classroom instruction and learning

A search for literature addressing the relevance between neuroscience discoveries for how the brain learns and applications for the classroom produced a modest quantity; however, the opinions about the relevance and application were must more expansive. The opinions are primarily divided between three distinct perspectives. Opponents, or skeptics, of the relevance claim that educators are not scientists and the leap from the lab to the classroom is just too far. The advocates for brain-based instruction see clear, applicable ties between current neuroscience discoveries about the brain to instruction in the classroom. The third perspective come from within the science community itself.

The opinion of the neuroscientists was that their findings, while relevant to education, advised that it needed to be mediated through one of the other social sciences such as cognitive or behavioral psychology. The critics of “brain-based instruction” indicated that the advocates seemed to be more driven from a commercial motivation rather than actual scientific validity. They further argued that products were rushed to market as early as the 1990s, ahead of any clear explanations and applicability from the scientific community. They disdained the claims of brain-friendly strategies for improving student performance as false advertising and not scientifically based. In fairness to the brain-based advocates, much of the criticism was published in the late 1990s to early 2000s, so the criticism may have been justified at the time, but the imaging technology and studies have continued to advance with further discoveries. Additionally, more recent literature has been published from the social sciences, and even the medical community, that have discussed numerous discoveries from neuroscience and shown them to be valid for educational application.

The findings and reports from cognitive, behavioral, and educational psychology indicate that learning engages the whole physiology, both the body and the brain. Stress or threat can shut down the brain, inhibiting learning because the brain goes into “survival” mode. The limbic system is shown to facilitate the linking of emotions to learning, as well as memory, and motivation. This region of the brain also is a connector between the other regions at processing and attaching emotions to input. The cerebral cortex region is where the brain makes sense of incoming information from the senses, through language, conscious behavior, complex memory, judgement and reasoning. This is the area responsible for what is called executive functioning, or is the “boss” for organizing, assimilating, storing, and overall processing of information.

Other findings from neuroscience reveal the value of repetition, or exposure to similar information at repeated intervals for continued development of dendrites. Neuro-imaging reveals that dendrites appear to have a “use it or lose it” quality as evidenced by memory loss; therefore, revisiting and repeating information promotes active processing or looping thus fostering long-term memory and retrieval. This scientific discovery was merely validation for practice that had been in play for many years in classrooms around the world, memorization through repetition to develop automaticity.

In other studies it was discovered that when learning a new physical skill, the frontal lobe, the motor cortex, and the cerebellum are all in use or activated at the same time until the skill has become mastered. Once the skill has become mastered the control center for the activity shifts to just the cerebellum so that working memory is freed up to learn new information. The brain also has cycles of learning, the up part of the cycle is the “prime time” for learning to occur. These three discoveries about how the brain functions demonstrate to educators that learning is more than just content, but pacing, repetition, and orchestrated “multi-tasking” activities in order to optimize learning opportunities.

Additional research findings from the neuroscience community were not directly related to brain-based instruction, but had implications for barriers to learning. The findings about the effect of viewing violence in movies and games is directly relevant to the demographics in my classroom. The brain responds to these visions as if it had actually experienced the events. Along with the negative structural and functional changes that occur through extended exposure to screen time create a scenario where students have unwittingly subjected themselves to trauma and are suffering brain damage. This brings a whole other dimension to trauma-informed care. Furthermore, findings on the neuro-toxic effect of alcohol and cannabis use—both consequential and causal—revealed developmental delays, impaired memory including working memory and recall, attention, perceptual reasoning, and inhibitory control.

This small sample of scientific findings holds significant implications for my practice in a high school classroom of students with learning disabilities in a Title I school. I recognize the need for more knowledge about my students to better understand the what barriers stand in the way of academic progress in my room. An ESER or IEP often fails to reveal pertinent health facts from birth difficulties or exposure to neuro-toxic substances. Each year begins with some "get acquainted" activities, but it will now include questions about hobbies and activities revolving around screen time for iPads, games, computers, and smartphones.

5. Conclusion

The findings of the meta-synthesis highlight the serious underachievement of boys across K-12 education. The evidence shows that boys and girls approach education differently, learn differently, and respond differently to non-cognitive variables such as family composition or socio-economic status. The review of literature from the science community reveals that there are developmental, structural, and functional differences between the brains of boys and girls however, the degree to which these differences impact or contribute to this gap in achievement was not clearly established but highlights a potential area for future research.

The advances in neuroscience, specifically fMRI, have provided images of the brain while an individual performs various physical and cognitive tasks. While these images are expanding scientists' understanding of how the brain functions and learns, it takes further evaluation and mediation from the work of behavioral, cognitive, and educational psychologists to translate the images into information usable for classroom instruction. Consequently, other findings about the neurotoxic effect of alcohol and cannabis usage on the brain highlight the deficits that may also be a part of the negative performance and underachievement for boys. The structural and functional changes to the brain may not respond to instructional strategies with the same results; thus, this may be an area that requires further research as the neurotoxic changes may affect the neuroplasticity of the brain that has been touted in recent years.

As the body of literature on brain function has continued to grow, so has the expansion of brain-based or brain-compatible methodology. With the increased focus in some regions of the country on the academic needs of boys, some schools have implemented brain-based strategies and even all-boy classrooms in an effort to see academic improvement. The results have been mixed, and not as successful as administrators had hoped to achieve. Brain-based strategies have also shown to be successful in some situations, but the findings were mixed for both boys and girls across the different sample sizes and research settings. Some developers of brain-based programs and curricular materials emphasize the utilization of computerized learning and support applications with tutorials, instructional videos, and games to "appeal to boys" or help “struggling readers”. This seems to be in direct conflict with the neuroscience that demonstrated the structural and functional changes in the brains of children who had been exposed to extended periods of screen time via computers, videos, TV, tablets, and smartphones.

The methods that seemed to realize the most significant impact were the non-cognitive variables of empathy, humor, extended time to work, and a relaxed pace or non-pressured atmosphere. When boys had a role model or teacher who demonstrated genuine caring and high expectations with a pattern of consistence in their life, they demonstrated increased interest in education, thus realizing improved academic performance. These were not just emotional or behavioral methods, they were *brain-based* in that they created a dopamine response to acceptance and affirmation in a safe learning environment. Human engagement through direct conversations, authentic interest, and genuine caring is the most effective brain-based instruction for boys and girls alike, for those with and without disabilities.

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