VALUATION OF ACHIEVEMENT DIFFERENCES AND PSYCHOLOGICAL DIFFERENCES BASED ON HANDEDNESS OF LEFT-HANDED AND RIGHT-HANDED SCHOOL STUDENTS

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ABSTRACT

The research article entitled 'Valuation of Achievement Differences and Psychological Differences based on Handedness of Left-Handed and Right-Handed School Students'. Researchers have questioned whether being left-handed in a right-handed world effects an individual's personality. In some studies, it was found that left-handed individuals were significantly more unstable than right handed individuals. A few studies focused on locus of control differences between left-handed and right-handed individuals. An individual is considered to have an external locus of control when he/she perceives the reinforcement that follows an action to be the result of fate, chance, or luck. Conversely, an individual that perceives reinforcement as the result of his/her own action or behavior is considered to have an internal locus of control (Rotter, 1966). The major objectives of the study were to identify the age of hand dominance in school students; to study degree of age of hand dominance in school students; to identify the psychological differences based on handedness in school students; to study the difficulties of being left-handed in school students; to examine environmental influences in school students, and to identify the achievement differences based on handedness in school students. Researcher collected data from secondary sources. The researcher collected data from Educational Psychology books, Research Articles about left handedness and right handedness school students in relation to their achievement differences, and psychological differences based on handedness, and Articles of experts in various newspapers related to left handedness and right handedness school students in relation to their achievement differences, and psychological differences based on handedness. The present research adopted a systematic review and meta-analysis model to combine data from independent studies to draw a single conclusion with greater statistical power. Meta-analysis is a model that reviews the research results and combines the data obtained from independent studies in statistical ways. This meta-analysis aimed to answer the research objectives and research questions of the study. The major findings of the study were under six headings. Relating with Age of Hand Dominance: although there is not a rigid time schedule, and there are individual differences, children follow a comparable sequence of handedness fluctuating between unilaterally (right hand preferred or left hand preferred) with each hand being dominant at times and bilaterally (using both hands equally); and there is no clear-cut division between being left handed and being right handed; instead there are levels of dominance with completely left handed and completely right handed being at each end of the spectrum. Relating with Degree of Dominance: there is a need for assessing the degree of handedness during research and teaching, cautioning teachers not to generalize the potential problem areas because, depending on the degree of handedness, some tasks might be carried out with the left hand whereas others are carried out by the right hand; the degree of hand preference alone does not provide a clear picture of the individual's laterality; handedness should not be considered as only which hand an individual uses to write with but viewed as an entire system of interrelated functions including eyedness and footedness, referred to as laterality; and there is a relationship between handedness and eye dominance, contending that writers and readers need to position their writing tools and hand on the paper to accommodate the dominant field of vision. This creates one of the many

difficulties faced by left-handed people. Relating with Difficulties of Being Left Handed: although some tasks are difficult to overcome, writing and writing utensils appear to cause some of the most difficult problems, both mechanically and socially for the left-handed person; writing letters in the acceptable way causes the left-handed person to go against their natural instincts of moving away from the body's midline (right to left). Consequently, this causes left-handed children to be slower, more awkward and uncomfortable in their hand and body positions; there was no significant difference in speed and quality of left-handed and right-handed writing; and not only are left-handed people laden with unflattering nicknames, but they have also been the subjects of abusive treatment for following their natural instincts. Relating with Environmental Influences: left-handed children were seen as rebelling against authority if they used their left hand since school was the first place that the idea of left handed versus right handed emerged. Through these reprimands left-handed children suffered feelings of shame, abnormality, and inadequacy; many left-handed children can be embarrassed about the difficulty they are having and instead blame themselves rather than the equipment. Therefore, it is not surprising some children change their own hand preference in order to be more accommodating; the left-handed students were neglected and subjected to poor instruction, maintaining that if the ability to learn was the same between left-handed and right-handed children that it would be hard for left-handed children to overcome the manipulation of information to make sense; teachers have no formal training on how to teach left-handed children properly because methods are developed for right-handed learners; and the only help for left-handed children comes from either a left-handed teacher or a teacher with a left-handed child, suggesting that only those teachers who have experienced the difficulties faced by left-handed learners first hand are aware of how important accurate assistance is to the learning process. Relating with Achievement Differences Based on Handedness: the consistency in hand preference during infancy and the preschool years is important for intellectual development and predicts language asymmetries; those who establish this early are better coordinated than those who might establish hand preference later or not at all; left-handed children were definitely slower in developing speech and language skills than right-handed children but believed that, with the proper training, left-handed children could eventually catch up with right-handed children in linguistic development; in the case of gifted left- and right-handed groups, provided evidence that performed comparably in areas of motor, vocabulary, pre-reading and quantitative skills; conversely, when comparing normal left- and right-handed groups, differences occurred in the areas of vocabulary, memory, spatial and motor skills, with the right-handed group doing better; there is no evidence to support the suggestions found in the older literature and made by teachers that left-handed children are poorly coordinated and inferior to right-handed children with regard to motor abilities; and there are no significant differences in terms of handedness on any tests performed and went on to say left-handed groups are ideal in researching differences in cerebral organization. Relating with Psychological Differences Based on Handedness: the left-handed individuals were significantly more unstable than right handed individuals. A few studies focused on locus of control differences between left-handed and right-handed individuals; there are no significant differences between any of the handedness group means relating to personality in terms of locus of control and tolerance for ambiguity; in terms of depression inventory scores, it was found the mixed left-handed group was marginally higher in scores when compared to the right handed group. None of these were statistically significant findings; the right-handed respondents rated themselves as less emotional than by left-handed respondents; there was no significant relationship between handedness and anxiety scores but did indicate that mixed-handed individuals tended to select less extreme responses to items; and relating with levels of anxiety, left-handed and right-handed students had the same levels of anxiety.

KEYWORDS: ***Left-Handed School Student, Right-Handed School Student, Achievement Differences in School Students, Psychological Differences in School Students.***

1.0 INTRODUCTION

Handedness is defined as the dominant preference of one hand for performing functional assignments that can be accomplished with one hand. About 90% of people are right handed. Despite this fact, only in 70% of the left-handed individuals, the right hemisphere is dominant for language. Structural and functional cerebral hemispheres have differences, and each of them has been specially trained for certain cognitive functions. Human beings and their natural abilities may be described as superior to the right or superior to the left. There are three different, even contradictory approaches, most of them try to justify the relationship between superiority and mental abilities of the people. The rate of the right-handedness and lefthandedness was 24.3% and 27.3%, respectively in the study by Noroozian et al. The findings of the study by Solgi and Alipour indicated that the right-handed students had a higher level of self-awareness, alertness, and social skills compared to the left-handed ones. In another study, the level of emotional reactivity and anxiety was higher respectively in the lefthandedness and the right-handedness, and the difference was statistically significant, but there was no significant difference between the two groups in terms of stress and depression. This study was carried out with the aim of determining the relationship between handedness and academic achievement in high school students of Sanandaj City, Iran, in 2016.

Handedness is the polymorphic trait in human. Research shows that 90% of adult populations said to be right- handed and remaining 10% consisting of person variability identified as left-handed, ambidextrous or ambiguously handed (Mc Manus C, 2002, Soper et al, 1986 Ferrarim, 2007), Left handed are in the minority in all human population. It needs to be accepted here that educational practices are framed, and education first developed in such a manner which suit the requirement of Right handed Students. No specific provision is made for Left-handed student while constructing various infrastructure facilities and instructional facilities in educational institute. No specific provisions are made available to the left-handed students with regards to the various results under the psychomotor domain of educational object under Bloom’s taxonomy of educational objectives.

1.1 STATEMENT OF THE RESEARCH PROBLEM

We have all encountered individuals who perform certain tasks with their right hand, some activities with their left hand, and others with both hands. In recent years, researchers in the field of neuropsychology have been intrigued by this phenomenon, leading to extensive investigations. Neuropsychology is an interdisciplinary approach that studies the relationship between brain function and behavioral and higher mental processes (Kolb & Whishaw, 2009). Neuropsychologists use specific techniques to study brain-behavior relationships in normative individuals, referred to as Lateral Studies. In these studies, information reaches one hemisphere faster through direct pathways, and small differences in accuracy and processing speed in the two hemispheres are measured. Another method used in lateralization studies is the examination of the phenomenon of handedness (Alipour, 2008). Left-handed people exhibit creative artistic skills such as musical abilities, whereas right-handed students perform better in mathematics, according to Shirouni et al. (2008). Barnett & Corballis (2002) demonstrated that left-handed individuals engage in more creative activities. McCrae (2010) and Khosravizadeh and Teimourzadeh (2010) also suggest that right-handed individuals tend towards convergent thinking, while lefthanded individuals lean more towards divergent thinking. Alipour and Akhoundi (2011) demonstrated in their research that left-handed student scored higher in judicial thinking style and overall thinking style compared to right-handed students. However, right-handed students scored higher in executive thinking style and partial thinking style. Left-handed participants exhibited a right visual field bias in Shafiei and Ali-pour's (2011) study, which examined the effect of handedness on emotional face processing lateralization. They perceived emotionally presented faces in the right visual field significantly faster than in the left. Significantly, this tendency applied to agitated

faces. Right-handed participants did not exhibit any discernible effects from emotional face processing lateralization. Significant differences were found between lefthanded and right-handed people in overall intelligence, verbal intelligence, and many verbal intelligence subscales (information, numerical comprehension, and subject comprehension), according to Alipour and Saleh Mirhoseini (2011). Left-handed individuals scored higher overall and in verbal intelligence than right-handed individuals in this study. Another research effort studied the connection between family handedness and mental rotation ability; the findings showed that family handedness had a major impact on mental rotation ability. Furthermore, there was a substantial variation in the impact of familial handedness (depending on gender) on mental rotation ability (Alipour & Baghban Parshokouhi, 2008). Alipour and Mardanirad (2012) demonstrated that the majority of left-handed participants rotate towards the right, while the majority of right-handed individuals rotate towards the left, indicating a significant difference in handedness and rotation. Numerous studies show that children with autism have better levels of creative ability and visual-spatial skills than children in the general population, as well as a higher incidence of lefthandedness. A case study by Selva (1997) mentions a girl with autism named Nadia, who is also left-handed. At the age of 3.5, Nadia demonstrated beautifully detailed and delicate drawings. When she underwent treatment, her skills experienced some decline and impairment, but it is unclear whether this decline is due to continued treatment or a result of her natural maturation. Morfit & Weekes (2001) showed that autoimmune diseases are more prevalent in left-handers, and left-handers with a minimum of one autoimmune illness exhibit greater severity of left-handedness compared to those without autoimmune diseases. Crow (1996) states that individuals with psychiatric disorders are more likely to be left-handed or ambidextrous compared to normal individuals and nonpsychiatric patients. Dual-handed and left-handed children are more likely to develop psychiatric disorders in the future, and asymmetry in the gyrus area is related to left-handedness (Shapleske, 1999). Pore (1997) examined the relationship between traits of borderline personality disorder and handedness in a non-clinical sample of students. The data showed that individuals who scored higher on the borderline personality disorder questionnaire had a higher degree of non-right-handedness. There is a significant correlation between handedness preference and borderline personality disorder, as well as cognitive and perceptual impairments. Faustman (1991) investigated the responses of 48 male schizophrenic patients using the Luria-Nebraska Neuropsychological Battery. He compared the responses of 24 left-handed patients with 24 right-handed patients and included a control group consisting of 15 left-handed and 15 righthanded individuals (matched for age and education). The results indicated that left-handed patients exhibited weaker responses in some components of the test, which are more sensitive to cognitive deficits, compared to right-handed patients and the control group. Haken et al. (1971) declared that there is substantial evidence suggesting that lefthandedness is more common among children with intellectual disabilities and neurological disorders (Kiani, 2001). Moreover, if there is a congruence between an individual's cognitive style, handedness, and creativity, it is likely to contribute to their progress and assist them in solving visualspatial problems. According to Ant's theory (1992, 2002), tasks involving spatial and verbal skills exhibit different relationships with handedness. Individuals with left-handed dominance patterns tend to perform better in spatial and visual tasks, while those with right-handed dominance patterns excel in verbal tasks. Researchers posit that the direct relationship between the right hemisphere and spatial-visual tasks results in different organizational structures in the brains of right-handed and left-handed individuals (Peters, Reimers & Manning, 2006). The GBG model, in medical investigations, has gathered empirical evidence supporting this theory. For instance, Fasmer (2007) reported a positive correlation between left-handedness and mild migraine. It has also been observed that left-handedness in hand and eye dominance is more prevalent in children with autism (Springer, 1998). Various studies confirm the relationship between elevated levels of androgenic hormones during prenatal periods and enhanced performance in visual-spatial problem-solving, as seen in the research by Anders and Hampson (2005) and the results of Resnik

and colleagues (1986), aligning with the hypothesis of the impact of androgenic hormones on spatial problem-solving skills during fetal development. Krommydas and colleagues (2004) demonstrated that fetal sensitivity to testosterone increases the likelihood of concurrent lefthandedness and bronchial asthma. Shimoda and colleagues (2008) concluded that there are significant differences in visual-spatial cognitive functions related to lateralization between right-handed and left-handed individuals. Thomas Reio and colleagues (2004), who investigated the relationship between handedness and six different types of visual-spatial skills, showed that, overall, left-handers outperformed righthanders. Parsons (2004), in a study on sexual differences in mental rotation and spatial abilities, demonstrated that girls and boys differ in pencil-and-paper tests. Norouzian (2007), in a study on university entrance exam volunteers over five years (1993 to 1998), revealed that left-handers had a higher chance of acceptance in mathematical fields, and this probability was higher for boys than girls. The results of Hodges and colleagues (2008), Kratzig and Arbuthnott (2006), Cassidy (2006), and Jackson and Williams (2003) indicate a connection between field-independent cognitive styles and academic achievement. Research findings indicate that people with field-independent cognitive styles exhibit greater levels of concentration and accuracy (Guisande et al., 2007), higher decision-making and reasoning abilities (Peters, 2002), higher general intelligence (Richardson & Turner, 2000), and better working memory capacity (Bahar & Hansell, 2000) compared to field-dependent individuals. Elwood and Klenowski (2002) and McAlpine (2000) demonstrated that cognitive styles of students in humanities differ from those in basic sciences and technical fields. On the other hand, creativity or innovation is one of the fascinating and debatable subjects in various scientific fields, especially psychology. Throughout history, it has been considered as the fundamental power of the human mind and the main goal of schools and educational centers. In the present era, students need to enhance their creative skills to effectively face the astonishing developments of the third millennium for appropriate decision-making and solving complex societal problems (Ganji, Pashasharifi, & Mirhashemi, 2005). Undoubtedly, creativity holds a special place in individual and social human life, as all human achievements and civilizations, past, present, and future, are the products and outcomes of creativity. In the contemporary era, the extraordinary importance and vital necessity of creativity are increasingly recognized, exerting full control over all dimensions and aspects of human life (Golestanhashemi, 2001). Ganji et al. (2005) demonstrated in a study titled "The Effect of Brainstorming Method on Increasing Creativity" that the brainstorming method effectively increased creativity in experimental groups of boys and girls. Regarding the four components of creativity, the effect of brainstorming on increasing the components of initiative, fluidity, and flexibility in boys and the components of fluidity and expansion in girls was significant. Dabbaghi (2003) compared critical thinking and creativity of third-year high school students in mathematics, humanities, and experimental sciences in Pakdasht. The results showed that critical thinking and creativity of third-year math students were significantly higher than the other two fields. Vakili and Amini (2010), in a study titled "Investigating the Educational Resources of Creativity Flourishing in Elementary School Students from the Perspective of Elementary School Teachers in Helilan Region, Ilam Province," found that there is a relationship between teacher teaching and creativity flourishing of elementary school students, and there is a relationship between textbook content and creativity flourishing of elementary school students. Maher et al. (2007) showed that intimate and simultaneous relationships with interest and respect play an effective role in the emergence of students' creativity. Jahani (2006) aimed to examine the impact of various creative teaching methods on fostering the research spirit of adolescents. The study was carried out on a sample of 75 students from second and third-grade guidance school students in Shiraz. The results showed that creative teaching promotes argumentative skills and develops creativity among learners. Studying and researching in the field of cognitive styles, handedness, and creativity is also beneficial for school executives, managers, and teachers. The awareness of school officials about cognitive styles and

the issues of handedness and creativity and their impact on academic activities, including problem-solving, one of the practical and fundamental goals in education, necessitates supportive actions in this area. By creating suitable facilities for all students, such as academic counseling and educational programs, other actions increase the educational experiences of students. Additionally, according to the belief of some researchers, if contrary to the child's inner desire, we push them towards right-handedness, it can create unpleasant conflicts in the child and may lead to serious disorders such as language impairment and a sense of humiliation (Dadsetan, 1999).

1.2 OBJECTIVES OF THE STUDY

- To identify the age of hand dominance in school students
- To study degree of age of hand dominance in school students
- To identify the psychological differences based on handedness in school students
- To study the difficulties of being left-handed in school students
- To examine environmental influences in school students
- To identify the achievement differences based on handedness in school students

1.3 RESEARCH QUESTIONS OF THE STUDY

1. What is the age of hand dominance in school students
2. What is the degree of age-related hand dominance in school students?
3. How do psychological differences vary between right-handed and left-handed school students?
4. What difficulties do left-handed students face in school?
5. How do environmental influences impact school students?
6. Do school students exhibit different achievement levels based on their handedness?

1.4 DEFINITIONS OF OPERATIONAL TERMS

- **Left-Handed School Student:** Left-handed school students represent the preference for using the left hand for most activities.
- **Right-Handed School Student:** Right-handed school students represent the preference for using the right hand for most activities, with right-handedness being the dominant preference worldwide.
- **Achievement Differences in School Students:** Achievement differences in school students, often called the achievement gap, refer to disparities in academic performance, grades, test scores, and other indicators of success between different groups of students
- **Psychological Differences in School Students:** In school settings, psychological differences among students refer to the variations and similarities in their cognitive abilities, personality traits, learning styles, motivations, and emotional responses.

2.0 REVIEW OF RELATED LITERATURE

The age at which children show their preferred hand has been debated. Gesell and Ames (1947) indicated that marked handedness is not clear cut until about the age of 10. Their research examined the manual responses of children developmentally between 16 weeks and 10 years of age. Heslet (1984) asked if there was a difference between left-handed and right-handed students on self-concept using the Piers-Harris Children's Self-Concept Scale. The study had 111 students in fourth and fifth grades. Of these students 16 were left handed and 95 were right-handed. Results indicated that left-handed students felt better about themselves in terms of physical appearance and attributes, and they scored higher in happiness and satisfaction. Heslet (1984) reported that, although there was no significant difference in self-concept between right-handed and left-handed

students, left-handed students scored higher overall on the Piers-Harris Children's Self-Concept Scale. Heslet (1984) hypothesized that the higher scores by the left-handed students might indicate that self-concept is strengthened by being different. Conversely, Thurlow (1976), studied 15 left-handed and 15 right-handed students (ranging in age from 7-12 years old) from two elementary schools using the Piers-Harris Children's Self-Concept Scale and found no statistically significant difference between the two groups in terms of self-concept, though results did favor that the right-handed students. Lewis et al. (1986) argued that children under the age of 5 years are likely to switch hand preference or show evidence of ambidexterity, whereas after 5 years of age hand preference becomes a more reliable indicator of later handedness. Tan (1985) states that handedness is considered to be stable in most children by the age of 5 at least. Bloodsworth (1993) concluded that the period of switching between right and left hands is during the first four years of life. Bloodsworth states that approximately 60% of early education students are inconsistent in hand dominance.

3.0 DESIGN OF THE STUDY

3.1 Source of Data: Researcher collected data from secondary sources. The researcher collected data from Educational Psychology books, Research Articles about left handedness and right handedness school students in relation to their achievement differences, and psychological differences based on handedness, and Articles of experts in various newspapers related to left handedness and right handedness school students in relation to their achievement differences, and psychological differences based on handedness.

3.2 Methodology of the Study: The present research adopted a systematic review and meta-analysis model to combine data from independent studies to draw a single conclusion with greater statistical power. Meta-analysis is a model that reviews the research results and combines the data obtained from independent studies in statistical ways. This meta-analysis aimed to answer the research objectives and research questions of the study.

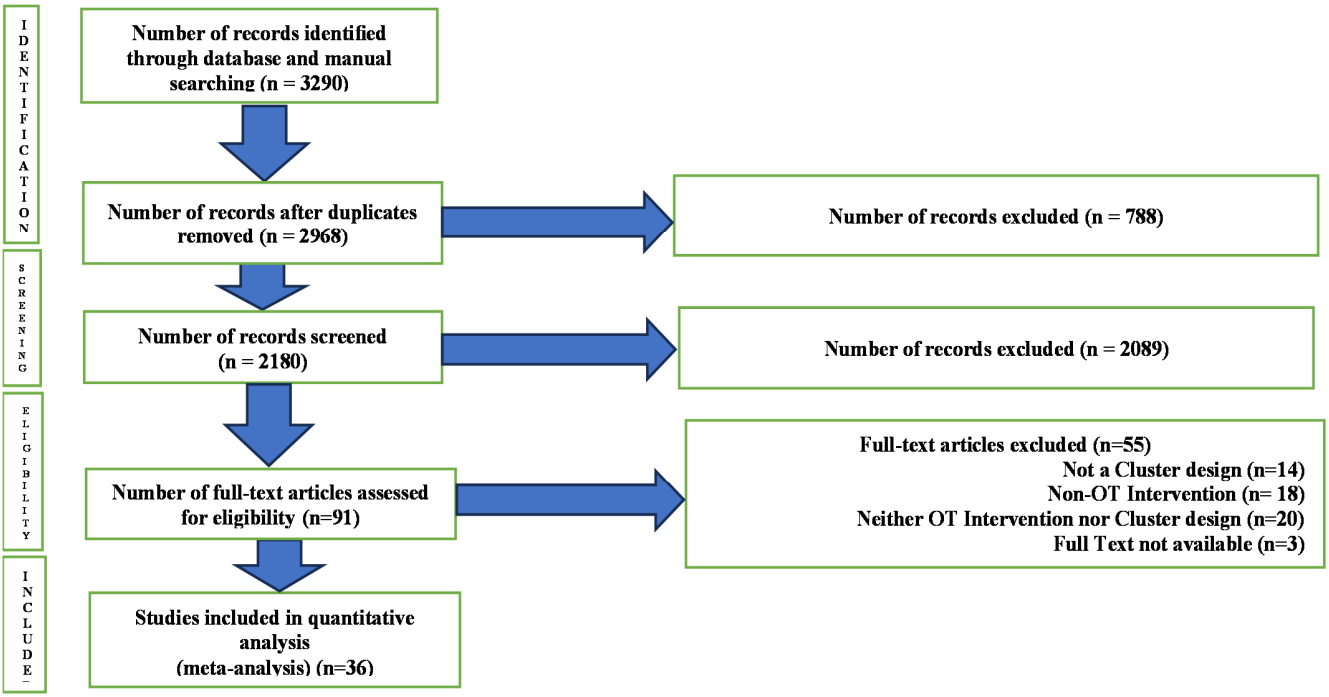

Figure 1 The Study Selection Process used in Meta-Analysis

Especially for this study finally 36 studies included, random-effects meta-analysis model has adopted. A random-effects meta-analysis is a statistical method that assumes that different studies in a meta-analysis estimate different but related intervention effects. This is in contrast to a fixed-effects model, which assumes that there is one common effect across all studies.

4.0 ANALYSIS AND INTERPRETATION

Researcher analyzed and interpreted meta-analysis data by first ensuring a clear research question and defining inclusion/exclusion criteria for studies. Researcher conducted a systematic literature search, extract relevant data, and calculated effect sizes for each study. Finally, the researcher combined these results, assessed heterogeneity, and interpreted the findings.

4.1 DISCUSSION OF THE STUDY

Relating with Age of Hand Dominance, there has been discussion on the age at which children display their favoured hand. According to Gesell and Ames (1947), noticeable handedness does not become evident until approximately the age of ten. Their study looked at the manual reactions of kids ranging in age from 16 weeks to 10 years. The results demonstrated that children follow a similar sequence of handedness, varying between unilaterally (preferring the right hand or the left), with each hand being dominant at times, and bilaterally (using both hands equally), despite the lack of a strict time schedule and individual differences. According to Lewis et al. (1986), children under the age of five are more likely to exhibit ambidexterity or switch hand preferences, while hand preference becomes a more accurate predictor of eventual handedness after the age of five. According to Tan (1985), most children's handedness is thought to be stable by the time they are at least five years old. Bloodsworth (1993) concluded that the first four years of life are when people swap between their right and left hands. About 60% of early school pupils have inconsistent hand dominance, according to Bloodsworth. Even though hand dominance is significant for education, researchers are increasingly coming to the conclusion that the degree of hand preference domination is more significant.

Relating with Degree of Dominance, according to researchers there is no clear-cut division between being left-handed and being right-handed; instead, there are levels of dominance with completely left handed and completely right handed being at each end of the spectrum (Bloodsworth, 1993; Hollingworth, 1923; Tan, 1985). Researchers agree that there is a need for assessing the degree of handedness during research and teaching, cautioning teachers not to generalize the potential problem areas because, depending on the degree of handedness, some tasks might be carried out with the left hand whereas others are carried out by the right hand (Milsom, 1995; Tan, 1985). Researchers have gone on to find that degree of hand preference alone does not provide a clear picture of the individual’s laterality. In a study conducted by Casey, Brabeck, and Ludlow (1986), researchers went further by dividing right-handed, left-handed and ambidextrous individuals into two groups: those that have no left-handed individuals in their family (familial right-handed) and those that have left-handed individuals in their family (familial non-right-handed). Familial non-right-handed, those who had one or more left-handed or ambidextrous individuals in their family, benefited significantly from mental rotation instructions when compared both to their own control group and familial right-handed subjects who were given the same instructions. Also, when given the orientation instructions, familial non-right-handed showed significantly less post-test improvement than their control group. This suggests that right-handed

relatives of left-handed individuals are more similar in many respects to left-handed individuals than they are to other right-handed. Handedness should not be considered as only which hand an individual uses to write with but viewed as an entire system of interrelated functions including eyedness and footedness, referred to as laterality (Annett & Turner, 1974; Gesell & Ames, 1947; Hardyck, 1977; Trotter, 1974). Spillman, Friedman, and Hutchcraft (1994) found a statistically significant relationship between handedness and eye dominance, contending that writers and readers need to position their writing tools and hand on the paper to accommodate the dominant field of vision. This creates one of the many difficulties faced by left-handed people.

Relating with Difficulties of Being Left-Handed, many languages have dual meanings for the word left, leading to negative connotations for being left-handed. In Latin, which is a base language for many European languages, the word for left is sinister. In Spanish the word for left means malicious (Coates, 1996). In the French language the word for left is gauche, awkward and clumsy. The German word for left also means awkward. Mancino in Italian means left or deceitful or defective (Coates, 1996; Trotter, 1974). Nolevo is Russian for left or doing things the sneaky way (Trotter, 1974). Each of these negative meanings brings about a social world where being left-handed is not acceptable. There are many terms that refer to being left-handed in a negative way. Some of the most used terms are lefty, southpaw, backwards child, and left handers. Other sayings that are meant to be disparaging include: left wing, out in left field, two left feet, and a left-handed compliment (Howell, 1978). People that are right-hand dominant do not have to succumb to these disparaging nicknames. As mentioned before, there are many things used every day that have a right-handed bias. Bottle caps, vegetable peelers, serrated knives, scissors, musical instruments, gum wrapper tabs, chair desks, computer keyboards and many power tools, to name just a few, cause difficulty for the left-handed user (Coates, 1996; Hackney, 1997; Milsom, 1995; Trotter, 1974). Although these tasks are difficult to overcome, writing and writing utensils appear to cause some of the most difficult problems, both mechanically and socially for the left-handed person.

The act of writing poses a variety of difficulties for the left-handed person to overcome. Since writing takes place from left to right, the left-handed person cannot see what they have just written because their hand covers the writing. Many left-handed individuals accommodate by using a hooked position, which can cause problems because the arm does not have the full range of motion (Hackney, 1997). Not only not seeing what is being written causes a problem, but the left hand is dragged across the freshly written letters and smears the writing (Bloodsworth, 1993; Milsom, 1995). If the left-handed writer is using a pen, the nub of the pen is pushed rather than pulled across the paper the way the pen was designed to perform. This action can cause erratic ink flow and allows the writing to be smeared easier (Milsom, 1995). Writing letters in the acceptable way causes the left-handed person to go against their natural instincts of moving away from the body's midline (right to left). Consequently, this causes left-handed children to be slower, more awkward and uncomfortable in their hand and body positions. In addition, it causes left-handed children to experience more fatigue when engaged in prolonged periods of writing (Harrison, 1981). Letters such as b, d, p, and q are frequently reversed due to the circles that are involved in the creation of the letters (Hackney, 1997; Harrison, 1981; Simner, 1984). Given that circles are a frequent occurrence in writing, especially in numbers, reversals could be found in writing other figures.

Furthermore, the slant of the letters is more irregular, so the written product is usually less legible (Harrison, 1981). On the contrary, Coates (1996) found that there was no significant difference in speed and quality of left-handed and right-handed writing. Difficulty for left-handed children can develop early. Toys and clothing tend to have a right-hand bias. Part of children's early development is to learn to adapt and find effective ways of making things work (Milsom, 1995). This raises the question of what happens to those children that are unable to accommodate and what the psychological ramifications are for the left-handed child. Not only are left-handed people laden with unflattering nicknames, but they have also been the subjects of abusive treatment for following their natural instincts.

Relating with Environmental Influences, in the past teachers would rap the knuckles of a child who tried to use his or her left hand. Teachers would also tie the left arm behind a child's back to make the right hand the only usable hand (Milsom, 1995). Left-handed children were seen as rebelling against authority if they used their left hand since school was the first place that the idea of left-handed versus right-handed emerged (Bloodsworth, 1993). Through these reprimands left-handed children suffered feelings of shame, abnormality, and inadequacy (Bloodsworth, 1993; Coates, 1996; Milsom, 1995). Many left-handed children can be embarrassed about the difficulty they are having and instead blame themselves rather than the equipment (Milsom, 1995). Therefore, it is not surprising some children change their own hand preference in order to be more accommodating (DeYoung et al., 1998). Bloodsworth (1993) states that teaching left-handed students was first mentioned in 1915. The author went on to say that left-handed people were neglected and subjected to poor instruction, maintaining that if the ability to learn was the same between left-handed and right-handed children that it would be hard for left-handed children to overcome the manipulation of information to make sense. Teachers have no formal training on how to teach left-handed children properly because methods are developed for right-handed learners (Harrison, 1981; Milsom, 1995). The only help for left-handed children comes from either a left-handed teacher or a teacher with a left-handed child, suggesting that only those teachers who have experienced the difficulties faced by left-handed learners first hand are aware of how important accurate assistance is to the learning process (Milsom, 1995). Teachers are not the only people who attempt to change the preferred hand of the child; parents too are guilty. De Young et al., (1998) contended that switching handedness is likely more prevalent. When parents were asked, they readily admitted to researchers that they had deliberately changed their child's handedness from left to right. Parents could also inadvertently change the handedness by placing objects into the right hand. Parents of deaf children are also at risk for encouraging hand preference by modelling their child's right hand into the correct sign hand shape and following the child's hand through the correct sign movement (Bonvillian et al., 1993).

Relating with Achievement Differences Based on Handedness, according to Kee et al. (1987) and Tan (1985), consistency in hand preference during infancy and the preschool years is important for intellectual development and predicts language asymmetries; those who establish this early are better coordinated than those who might establish hand preference later or not at all. Children lacking a definite hand preference had significantly lower motor abilities (Tan, 1985). This raises concern with earlier findings that stability in hand preference does not occur until approximately

the age of ten. Many studies compared development and skills of left- and right-handed people. Banham (1983) found that left-handed children were definitely slower in developing speech and language skills than right-handed children but believed that, with the proper training, left-handed children could eventually catch up with right-handed children in linguistic development. On the contrary, Bower (1985) found that children who possessed extremely high levels of verbal or mathematical ability tended to be left-handed. Findings by DeYoung et al. (1998) indicated that mixed-sided children had more trouble reading. Another study, Lewis et al. (1986), provided evidence that gifted left- and right-handed groups performed comparably in areas of motor, vocabulary, pre-reading and quantitative skills. Conversely, when comparing normal left- and right-handed groups, differences occurred in the areas of vocabulary, memory, spatial and motor skills, with the right-handed group doing better. Tan (1985) found no evidence to support the suggestions found in the older literature and made by teachers that left-handed children are poorly coordinated and inferior to right-handed children with regard to motor abilities. Tan suggested that perhaps left-handed people are evaluated as less skilful just because their mode of action looks different from that of the right-handed majority. Hardyck, Petrinovich, and Goldman (1976) conducted handedness research on elementary students relating it to intellectual ability, motivation, scholastic achievement, and socioeconomic status. These researchers found no differences in terms of handedness on any tests performed and went on to say left-handed groups are ideal in researching differences in cerebral organization. A study by Hicks and Beverdige (1978) using college students found a significant difference in fluid intelligence between left-handed and right-handed students with left-handed students being inferior; these researchers caution that fluid intelligence (e.g. reasoning, matrices, mazes, and word groupings) deficits are not to be seen as a characteristic of left handedness. Further research by Hardyck (1977) concluded left-handed children are as likely to be at the upper end of an ability distribution as at the lower end. In other findings, Orme (1970) found that handedness was not related to intellectual ability. In Bemporad's (1986) dissertation, the left-handed subjects were the lowest performing group on all of the academic achievement tests while the mixed left-handed group was one of the highest performing groups. Although Bemporad reports that the left-handed group was also the lowest performing group on the majority of the cognitive tests (including verbal and spatial), she goes on to explain that none of the comparisons were statistically significant.

Relating with Psychological Differences Based on Handedness, researchers have questioned whether being left-handed in a right-handed world effects an individual's personality. Orme (1970) found that left-handed individuals were significantly more unstable than right-handed individuals. A few studies focused on locus of control differences between left-handed and right-handed individuals. An individual is considered to have an external locus of control when he/she perceives the reinforcement that follows an action to be the result of fate, chance, or luck. Conversely, an individual that perceives reinforcement as the result of his/her own action or behavior is considered to have an internal locus of control (Rotter, 1966). Jakobsen (1983) conducted a study to determine if handedness had an effect on personality in terms of locus of control and tolerance for ambiguity. Her sample consisted of 102 graduate students, nine left-handed, from statistics, research,

psychology, and speech pathology classes. The study found no significant differences between any

of the handedness group means. Jakobsen hypothesized that the small number of left-handed subjects may have affected the precision of the statistical analysis. Hicks and Pellegrini (1978b), also using an adult sample, found that both left- and right-handed individuals scored significantly higher than mixed-handed individuals in terms of being more externally controlled on locus of control constructs. In the only study conducted using school-aged students, Alony (1997) found that the 974 right-handed students and the 108 left-handed students did not differ in terms of motivation and locus of control, but the teachers indicated that left-handed students had significantly lower social skills. This finding is similar to the studies with adult subjects.

In terms of depression inventory scores, Bemporad's study (1986) found the mixed left-handed group was marginally higher in scores when compared to the right-handed group. None of these were statistically significant findings. In a study by Harburg, Roeper, Ozgoren, and Feldstein (1981) using data collected in the Tecumseh Community Health Study, researchers studied answers to a questionnaire answered by members of the study. Findings indicated that right-handed respondents rated themselves as less emotional than by left-handed respondents. Likewise, Harburg and his colleagues produced similar findings. Bemporad (1986) found that, for self-esteem inventory scores, the mixed left-handed group was marginally higher in scores when compared to the right-handed group (the findings were not statistically significant). The effects of hand preference on anxiety level in individuals have been debated in several research studies. Hicks and Pellegrini (1978a) found that left-handed and mixed-handed groups of college students were significantly more anxious than the right-handed group. Conversely, French and Richards (1990) reported findings that handedness was not related to state or trait anxiety in volunteer subjects ranging from 16 to 67 years old. In another study using college students, Wienrich, Wells, and McManus (1982) found there was no significant relationship between handedness and anxiety scores but did indicate that mixed-handed individuals tended to select less extreme responses to items. Beaton and Moseley's (1984) study, also using college students, concluded there was no relationship between hand dominance and anxiety and, Alony (1997) concluded that left-handed and right-handed students had the same levels of anxiety. Handedness has been related to measures of self-concept. Researchers conclude that the more distinctive a characteristic, the more aware an individual becomes of the characteristic as being different (McGuire & McGuire, 1980; Thompson & Harris, 1978). Etaugh and Brausam (1978) studied left-handed and right-handed college students' responses to questions pertaining to the content of a picture which the subjects had been allowed to view for 2 ½ minutes. Results showed that left-handed students were more aware of the handedness portrayed in the picture than right-handed students. In a literature review, Thompson and Harris (1978) hypothesized that left-handed individuals would be more likely than right-handed individuals to identify themselves and others in terms of their handedness. They also state that left-handed people's experiences socially (whether positive or negative) as related to handedness could contribute to the awareness of being unusual but would not be needed as long as the trait is directly apparent. Research by McGuire and McGuire, (1980) using both college students and public-school children, studied the spontaneous response to the statement Tell us

about yourself. Responses indicated the consciousness of the student's handedness. Results indicated that left-handed individuals were more likely to attend to the characteristic of handedness in their concept of self. Alony (1997) found that left-handed and right-handed Israeli schoolchildren ages 8 to 11 years old had the same scores in terms of self-concept. Heslet (1984) asked if there was a difference between left-handed and right-handed students on self-concept using the Piers-Harris Children's Self-Concept Scale. The study had 111 students in fourth and fifth grades. Of these students 16 were left-handed and 95 were right-handed. Results indicated that left-handed students felt better about themselves in terms of physical appearance and attributes, and they scored higher in happiness and satisfaction. Heslet (1984) reported that, although there was no significant difference in self-concept between right-handed and left-handed students, left-handed students scored higher overall on the Piers-Harris Children's Self-Concept Scale. Heslet (1984) hypothesized that the higher scores by the left-handed students might indicate that self-concept is strengthened by being different. Conversely, Thurlow (1976), studied 15 left-handed and 15 right-handed students (ranging in age from 7-12 years old) from two elementary schools using the Piers-Harris Children's Self-Concept Scale and found no statistically significant difference between the two groups in terms of self-concept, though results did favor that the right-handed students.

5.0 FINDINGS OF THE STUDY

5.1 Relating with Age of Hand Dominance

- Although there is not a rigid time schedule, and there are individual differences, children follow a comparable sequence of handedness fluctuating between unilaterally (right hand preferred or left hand preferred) with each hand being dominant at times and bilaterally (using both hands equally).
- There is no clear-cut division between being left handed and being right handed; instead there are levels of dominance with completely left handed and completely right handed being at each end of the spectrum.

5.2 Relating with Degree of Dominance

- There is a need for assessing the degree of handedness during research and teaching, cautioning teachers not to generalize the potential problem areas because, depending on the degree of handedness, some tasks might be carried out with the left hand whereas others are carried out by the right hand.
- The degree of hand preference alone does not provide a clear picture of the individual's laterality.
- Handedness should not be considered as only which hand an individual uses to write with but viewed as an entire system of interrelated functions including eyedness and footedness, referred to as laterality.
- There is a relationship between handedness and eye dominance, contending that writers and readers need to position their writing tools and hand on the paper to accommodate the dominant field of vision. This creates one of the many difficulties faced by left-handed people.

5.3 Relating with Difficulties of Being Left Handed

- Although some tasks are difficult to overcome, writing and writing utensils appear to cause some of the most difficult problems, both mechanically and socially for the left-handed person.
- Writing letters in the acceptable way causes the left-handed person to go against their natural instincts of moving away from the body's midline (right to left). Consequently, this causes left-handed children to be slower, more awkward and uncomfortable in their hand and body positions.
- There was no significant difference in speed and quality of left-handed and right-handed writing.
- Not only are left-handed people laden with unflattering nicknames, but they have also been the subjects of abusive treatment for following their natural instincts.

5.4 Relating with Environmental Influences

- Left-handed children were seen as rebelling against authority if they used their left hand since school was the first place that the idea of left handed versus right handed emerged. Through these reprimands left-handed children suffered feelings of shame, abnormality, and inadequacy.
- Many left-handed children can be embarrassed about the difficulty they are having and instead blame themselves rather than the equipment. Therefore, it is not surprising some children change their own hand preference in order to be more accommodating.
- The left-handed students were neglected and subjected to poor instruction, maintaining that if the ability to learn was the same between left-handed and right-handed children that it would be hard for left-handed children to overcome the manipulation of information to make sense.
- Teachers have no formal training on how to teach left-handed children properly because methods are developed for right-handed learners.
- The only help for left-handed children comes from either a left-handed teacher or a teacher with a left-handed child, suggesting that only those teachers who have experienced the difficulties faced by left-handed learners first hand are aware of how important accurate assistance is to the learning process.

5.5 Relating with Achievement Differences Based on Handedness

- The consistency in hand preference during infancy and the preschool years is important for intellectual development and predicts language asymmetries; those who establish this early are better coordinated than those who might establish hand preference later or not at all.
- left-handed children were definitely slower in developing speech and language skills than right-handed children but believed that, with the proper training, left-handed children could eventually catch up with right-handed children in linguistic development.
- In the case of gifted left- and right-handed groups, provided evidence that performed comparably in areas of motor, vocabulary, pre-reading and quantitative skills.

- Conversely, when comparing normal left- and right-handed groups, differences occurred in the areas of vocabulary, memory, spatial and motor skills, with the right-handed group doing better.
- There is no evidence to support the suggestions found in the older literature and made by teachers that left-handed children are poorly coordinated and inferior to right-handed children with regard to motor abilities.
- There are no significant differences in terms of handedness on any tests performed and went on to say left-handed groups are ideal in researching differences in cerebral organization.

5.6 Relating with Psychological Differences Based on Handedness

- The left-handed individuals were significantly more unstable than right handed individuals. A few studies focused on locus of control differences between left-handed and right-handed individuals.
- There are no significant differences between any of the handedness group means relating to personality in terms of locus of control and tolerance for ambiguity.
- In terms of depression inventory scores, it was found the mixed left-handed group was marginally higher in scores when compared to the right handed group. None of these were statistically significant findings.
- The right-handed respondents rated themselves as less emotional than by left-handed respondents.
- There was no significant relationship between handedness and anxiety scores but did indicate that mixed-handed individuals tended to select less extreme responses to items.
- Relating with levels of anxiety, left-handed and right-handed students had the same levels of anxiety.

6.0 CONCLUSION

Historically left-handed people have had to cope with disparaging nicknames, sayings and misunderstanding about being left-handed (Howell, 1978). The age of hand dominance has been debated for decades with the consensus maintaining that at about 5 years old children begin to have stability in hand preference (Bloodsworth, 1993; Gesell &Ames, 1947; Lewis et al., 1986; Tan, 1985). In conjunction with hand dominance, the degree of dominance plays a significant role in the level of functioning (Annett & Turner, 1974; Bloodsworth, 1993; Casey et al., 1986; Hardyck, 1977; Hollingworth, 1923; Milsom, 1995; Spillman et al., 1994; Tan, 1985; Trotter, 1974). In terms of psychological functioning, differences between left-handed and right-handed individuals have been assessed with regards to locus of control, depression, anxiety and self-concept (Alony, 1997; Beaton & Moseley, 1984; Bemporad, 1986; Etaugh & Brausam, 1978; French & Richards, 1990; Harburg et al., 1981; Heslet, 1984; Hicks & Pellegrini, 1978b; Jakobsen, 1983; Kalodner et al., 1994; McGuire & McGuire, 1980; Orme, 1970; Rotter, 1966; Thompson & Harris, 1978; Thurlow, 1976) . These areas are of particular interest due to the long-lasting consequences to many areas of functioning. Few studies have questioned the difference in locus of control with regards to hand preference. The studies found no difference between left-handed

and right-handed individuals in terms of locus of control but used college aged students as subjects (Jakobsen, 1983; Hicks & Pellegrini, 1978b). Only one study was found that measured the difference between the different degrees of handedness of left-handed and right-handed individuals with regards to depression scores. The depression scores were found to be higher for the mixed-left handed group (Bemporad, 1986). Due to the difficulty in studying depression in children, this construct will not be assessed in this study. Difference in levels of anxiety between left-handed, right-handed and mixed-handed individuals has brought conflicting reports. Hicks and Pellegrini (1978a) reported findings that left-handed and mixed-handed subjects reported higher scores on anxiety constructs than right-handed subjects. Wienrich et al., (1982) did not find differences in hand preference in terms of anxiety but found that mixed-handed individuals reported fewer extreme responses. Studies by French and Richards (1990) and Beaton and Moseley (1984) found no differences between hand preference and anxiety scores. Each of these studies used college aged students or older subjects. Studies regarding self-concept have been assessed in terms of hand preference. Etaugh and Brausam's (1978) study of college students found that left-handed students were more aware of their handedness, thus making it a more salient trait in their self-concept. A study by McGuire and McGuire (1980) using college students and elementary students as subjects found that handedness was related to self-concept. The findings by Heslet (1984) and Thurlow (1976) who each studied fourth and fifth graders, contradicted each other. Both studies indicated that the small sample size created a problem.

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