

The Effects of a Multisensory Method Combined with Relaxation Techniques on Writing Skills and Homework Anxiety in Students with Dysgraphia

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Abstract The academic problems and repeated failures of students with learning disabilities (LD) make them more prone to anxiety disorders. This article presents the results of an intervention program (VAKT and relaxation), addressing learning difficulties and homework anxiety in students with dysgraphia in Iran. Two groups of second through fourth graders, each consisting of three students with a prior diagnosis of dysgraphia, participated in this study. One student from each grade was randomly assigned to the experimental and control group. A Homework Anxiety Test and nine sets of spelling tests (separate forms for each grade with the same difficulty level) were used as the pretest, posttest and follow-up test. The results show that the experimental group benefited from the use of the combined method, with a significant decrease in writing mistakes and anxiety level. The joint effect of the program looks promising in promoting learning and reducing the anxiety problems in students with LD.

Keywords Multisensory method (VAKT), Relaxation, Homework anxiety, Dysgraphia

1. Introduction

About 8% of the student population in Iran suffers from learning disabilities (LD) (Seif Naraghi & Naderi, 2010). Hallahan, Lloyd, Kauffman, Weiss, and Martinez (2005) consider learning disability as one of many individual differences, and assert that each individual with a learning disability is unique. However, Borthwick-Duffy (1994) regards people with LD as a heterogeneous, psychosocially disadvantaged group, comprised of people who are more prone to psychological disorders (as cited in Cooray & Bakala, 2013). Since the inception of the field (e.g., Blanchard, 1936; Siegel, 1954), due to the academic problems and repeated failures of students with learning disabilities, many researchers have linked learning disabilities with emotional problems such as depression (Huntington & Bender, 1993; Bender & Wall, 1994; Bender, Rosenkrans, & Crane, 1999) and anxiety disorders (Gorman, 2001; Bailey & Andrews, 2003; Thaler, Kazemi, & Wood, 2010; Nelson & Harwood, 2011). However, these problems could remain unreported (Reiss, Levitan, & Szyszko, 1982), overlooked, and unidentified (Veerhoven & Tuinier, 1997).

Anxiety is not considered to be a normal reaction to a perceived stressor, although many people occasionally

experience it. As a component of human emotional structure, anxiety can be normal, motivational, and protective at optimal levels, thus helping to expand people's adaptive mechanisms to cope with adversity (Yerkes & Dodson, 1906). However, morbid anxiety (i.e., anxiety that becomes chronic and constant, excessive and disproportionate to the potential for harm, or in the absence of any rational or recognizable threat to the individual, with increased level of dread and arousal) is not only destructive, but also hinders activities, as it has the effect of disorganizing, rather than facilitating, an individual's performance (Dadsetan, 2007; Cooray & Bakala, 2013).

Students with homework anxiety demonstrate their fears in various ways. They often make up excuses for not doing their homework, forget to bring school assignments home, and become extremely agitated or depressed when they have homework to do. Many also complain of headaches, stomach pains, breathing difficulties, or tightness in the chest (Wong, 2009). According to Slattery (2009), the child may be blamed for being lazy, unorganized, or not keeping to his/her potential, while in fact, the child is disempowered by not knowing how or where to begin. Homework anxiety can affect any child, but as Zinkus (as cited in Nelson & Harwood, 2011) describes; an anxiety reaction develops in anticipation of possible academic failure, for those students who feel they lack the necessary skills for academic success.

Several theories have proposed an explanation for the possible relationship between LD and anxiety. Spren (1989) refers to three: primary disorder, secondary reaction, and

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cerebral dysfunction theories. Primary disorder and secondary reaction theories have a common stand, as both see this relationship having a cause and effect nature. Spreen argued that learning problems are caused by high levels of anxiety, and that anxiety develops as a result of learning difficulties. In contrast, cerebral dysfunction theorists propose that the co-occurrence of LD and anxiety is the manifestation of common underlying neurological problems. Secondary reaction theory is more appropriate to use as the theoretical basis of this research, as most of the LD students are identified and diagnosed primarily for their learning difficulties, however, the elevated problem encompasses cognitive, emotional, and functional elements (Akhavan - Tafti, 2011). Moreover, as the vicious cycle develops, LD and cognitive deficits can exacerbate emotional problems. Emotional problems may directly affect a child's learning disability by compounding the initial cognitive deficits or by indirectly influencing achievement by undermining the resources children have to overcome their learning disabilities (Gorman, 2001).

Problems with academic learning performance are most prevalent in reading, writing, and mathematics. In the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR), dysgraphia is characterized as a form of learning disability in the category of written expression, when one's writing skills are below the expected level, given a person's age, measured intelligence, and age-appropriate education (American Psychiatric Association, 2000). There are at least two parts in the act of writing: a linguistic part and a motor-expressive-praxis part. The linguistic part involves the encoding of auditory and visual information into symbols for letters and written words. The motor part refers to where the expression of written words or graphemes is articulated (Zandi, Nematzadeh, Samaii, & Nabifar, 2006). Research on dysgraphia has indicated various causes, including lack of attention (Tabrizi, 2010; SeifNaraghi & Naderi, 2010), weaknesses in motor skills (SeifNaraghi & Naderi, 2010), disorder in visual perception of words and letters (Tabrizi, 2010; SeifNaraghi & Naderi, 2010; Ronaghi et al., 1998), weaknesses in visual and auditory memory (Tabrizi, 2010; SeifNaraghi & Naderi, 2010; Mercer & Pullen, 2009; Ronaghi et al., 1998), difficulty in transferring information from one sensory channel to another, or in sensory connections and abstract non-concrete contents (SeifNaraghi & Naderi, 2010), and perceptual and cognitive dysfunctions such as difficulty with grammar, syntax structure, and executive functions involved in writing. These difficulties may be due to underlying problems in the development of cognitive automaticity, orthographic coding, and graphomotor output, leading to innumerable forms of writing mistakes (Akhavan Tafti & Asadi Bideshki, 2012). Common spelling errors are linguistic errors, which are mistakes and deviations from the written form of words in a language.

In Iran, students with dysgraphia not only struggle with the universally common problems, such as handwriting incoherence, transcription disability, and spelling mistakes,

but they also face many specific language-related challenges. In Farsi, some spelling mistakes stem from the very nature of its linguistic structure. There are 32 letters in the Farsi alphabet, some of which have the same sounds with different symbols. For example, the sound 'z' is symbolized by four different letters: ذ, ز, ظ, and ض. This is also true for sounds such as 's' and 't'. Thus, misspelling of words containing such sounds is frequent, especially for students with dysgraphia. To have correct spellings, linguistic knowledge is required. This can be referred to at different levels of language such as calligraphy and lexicon. Calligraphy information refers to calligraphy contracts of each language. In Farsi, for instance, many letter forms are position-dependent (i.e., whether at the beginning, middle, or end of a word). Lexicon information is related to word formation mechanisms. For example, in the words / hayat / and / heyvanat/, the spelling form of /t/ is predicted using information from different graphemes: ت or ط. In the first word, producing the correct form requires applying visual information, whereas in the second word, lexicon information should be used in terms of number (singular or plural). The other type of information used while spelling is called non-linguistic information and includes *visual information* and *ambiguous spelling parts*. Visual information refers to all the stored non-linguistic information related to the written form of a word in the visual memory. For example, choosing letter 'و' instead of 'ح' for the sound /h/ in the word راه /rah/ cannot be predicted using linguistic information; therefore, it is recalled from visual memory. Ambiguous spelling parts refer to the chains including one letter or a sequence of letters in a word, the spelling form of which does not directly reflect its/their sound system. In other words, there is not any corresponding relationship between their phonetic and written forms, which need to be memorized (Zandi, Nematzadeh, Samaii & Nabifar, 2006).

The teaching methods for students with any form of learning disabilities should be adapted to the individual needs of the student. One of the most effective and empirically supported practices is a multisensory method, in which teaching is done using all learning pathways in the brain (visual/auditory, kinesthetic, and tactile [VAKT]) simultaneously in order to enhance memory and learning. The VAKT method not only employs visual and auditory channels, but also emphasizes the kinesthetic sensory input provided by tracing and the tactile sensory input provided through varying texture of stimuli. Paivio (1986) proposed that information between each modality is linked through associative connections, whereas the information between channels is processed through referential connections. These referential linkages allow information from different modalities to interact. According to Hallahan and Kauffman (as cited in Seif Naraghi & Naderi, 2010), multisensory methods combine students' sensory systems in the teaching process in order to reduce their learning problems. Unlike most other teaching strategies, the VAKT method is based on the principle that some students learn best when redundant cues are provided through many sensory channels;

particularly, when kinesthetic and tactile components are added, students' attention to the task, and their engagement in the task, will be increased (Mercer & Mercer, 1985; Babapour Kheiraddin & Sobhi Gharamaleki, 2001; Thrope, & Sommer-Border, 1985). Lerner (1993) also asserts that the assumption of multisensory approach is that if information is received from multiple senses instead of one or two senses (visual and auditory), learning is facilitated and reinforced for some students (Danesh, 2005).

Empirical research concerning the educational benefits of teaching through mixed modalities indicates that recall and understanding of the subject matter is promoted in learners (Mayer & Moreno 1998; Clark & Paivio, 1991). Shahni Yeylagh, Karami, Shokrkonand Mehrabizadeh Honarmand (2003) conducted a study to investigate the efficacy of the application of multisensory method and its impact on improvement of educational performance in students with dysgraphia. The obtained results demonstrated that using this method significantly decreased spelling mistakes, and the results of the intervention were relatively stable.

When the student is relaxed and experiencing the optimal level of anxiety, s/he can learn better. Findings of prior research indicate that meditation, relaxation, and cognitive - behavioral training may be effective in reducing anxiety, promoting social skills, improving academic self-concept, and improving academic performance for students with learning disabilities (Beauchemin, Hutchins, & Paterson 2008; Davis, 1987, as cited in Akhavan Tafti & Asadi Bideshki, 2012; Wachelka & Katz, 1999; Frey, 1980). Muscular relaxation is a way of reducing anxiety. This involves loosening and tightening muscles and practicing deep breathing, which has been found to be more effective when coupled with visualization of positive memories and images (Sahebi, 2001).

Following assumptions helped generating the objectives of the study and research queries:

- Some studies, e.g. Cooray, and Bakala, (2005) have reported that anxiety disorders are as common, and probably more prevalent, among individuals with learning disabilities as among the general population.
- The argument put forward by secondary reaction theory regarding the compound effect of LD, and other cognitive deficits on emotional problems.
- Students with LD are more prone to stressful academic experiences due to continuous adversity, poor coping skills, and inadequate social supports and resources.

Hence the objective of the current study was to examine the efficacy of the designed combined method of "teaching as well as relaxation techniques", on helping students with dysgraphia reduce their homework anxiety and improve their academic performance. The following questions guided this study:

- 1) Does muscular relaxation help reduce homework anxiety in students with dysgraphia?
- 2) Does the multisensory method (VAKT) reduce

writing mistakes in students with dysgraphia?

2. Method

2.1. Participants

Participants included two groups of students from the second to the fourth grade. Each group consisted of three students. Each student had previously received a diagnosis of dysgraphia from a learning disabilities center affiliated with a special education organization in Tehran. The students of the two groups were homogeneous in terms of age (mean chronological age, 9.2), gender (2 boys and 1 girl), IQ scores (mean score, 101), and writing problems/spelling mistakes, with no history of sensory or physical problems. Students were randomly assigned to the experimental and control group.

2.2. Measures

The measures used in this study were designed by the researcher. Measures included: (a) a Homework Anxiety Test and (b) Spelling Tests. The Homework Anxiety Test was designed based on the Spence Children's Anxiety Scale (1994, 2003), along with the symptoms of homework anxiety. The students were asked to indicate how often each of the items has happened to them. Responses were measured on a four-point scale (0 = *never*, 1 = *sometimes*, 2 = *often*, or 4 = *always*). Scores were computed by adding the individual item responses, with a maximum possible score of 76, ($r=0.83$). Nine sets of Spelling Tests (used in pretest, posttest and follow-up) were prepared. Each included 20 words with the same level of difficulty (three sets for each grade), and were each validated by three experienced teachers. Words were chosen from textbooks considering common mistakes in each grade. Scores were calculated on the basis of number of mistakes.

2.3. Procedure

The study employed a single-subject A-B-A design, which included a baseline phase with repeated measurements, an intervention phase continuing the same measures, a post treatment phase, and follow-up phase. Each member of both groups was assessed separately on the Spelling and Homework Anxiety Tests. The intervention phase for the experimental group started and continued for 14 two-hour sessions. In each session, the individually designed program comprised of different fun, innovative, hands-on, and grade-appropriate VAKT learning activities were used along with relaxation exercises. In order to involve different sensory modalities through seeing, hearing, and doing, a number of stimuli of varying, look, sound, and texture were used. Students needed to watch, listen, copy, push, press, draw, trace, color, shape, and the like. Relaxation exercises included deep breathing, and progressive muscle relaxation (tensing and relaxing different body parts). Exercises were used twice in every session, (every half an hour), or

whenever needed (e.g. showing signs of fatigue, or stress). In the meantime, the control group continued with their routine education. Upon completion of the intervention program, post-tests were administered. After one month, the follow-up tests were taken from each member of both groups. For each student, parent's consent was taken for his/her participation in the study.

To examine changes in the dependent variables, the mean scores were calculated for the experimental and control groups, and figures were drawn and examined for the indices of level, variability, and trend. According to Engel and Schutt (2009), examining the level shows the amount or magnitude of change in the target variable, whereas a trend refers to the direction in the pattern of the data points and can be increasing, decreasing cyclical, or curvilinear. Finally,

variability refers to how different or divergent the scores are within a baseline or intervention phase.

3. Results

Figure 1. displays the differences in the writing mistakes of the two groups in each phase. The students in the experimental group performed better in spelling tests, and their writing mistakes dropped significantly during the intervention phase, and remained relatively stable in the follow-up phase (M pretest = 15, M posttest = 7.5, and M follow-up = 5.5). No significant change was observed in scores of the control group (M pretest = 15.22, M posttest = 15.77, and M follow-up = 14.88).

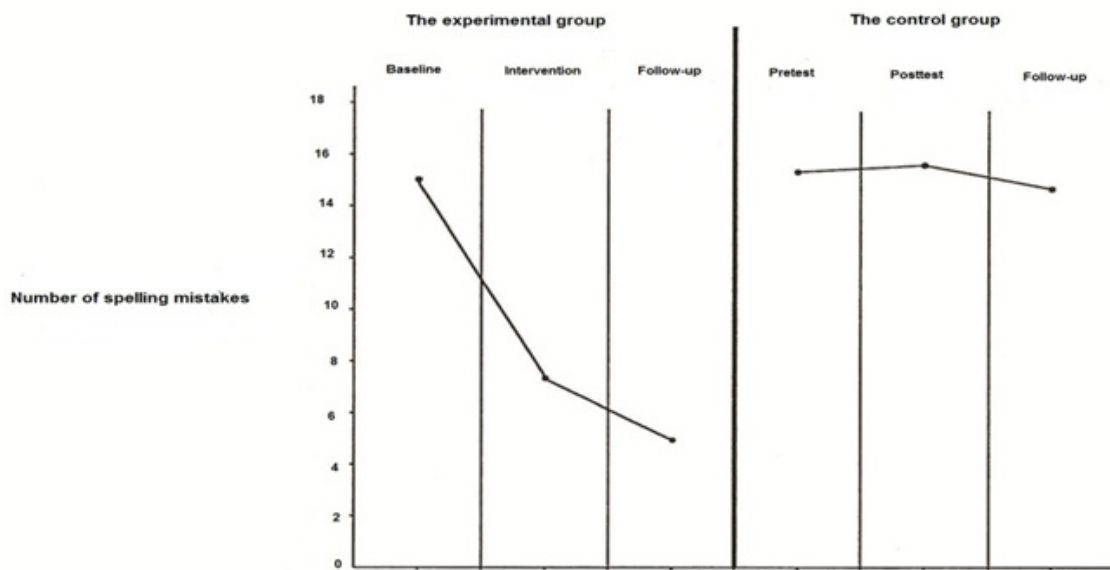


Figure 1. Students' Mean Number of Spelling Mistakes in the Experimental and Control Groups

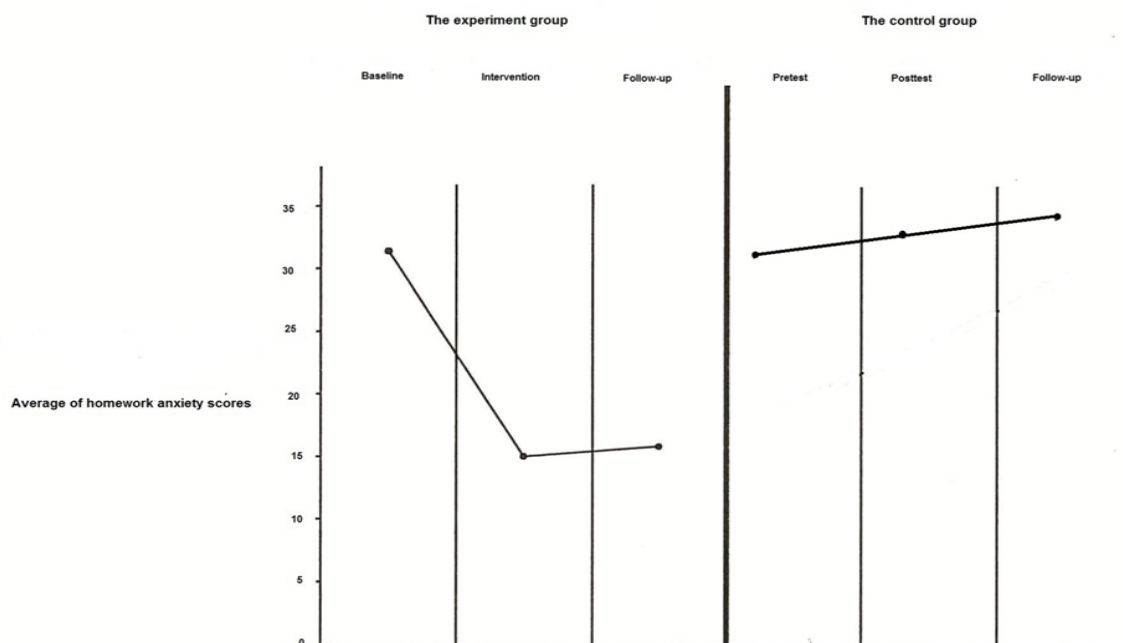


Figure 2. Students' Mean Scores of Homework Anxiety in the Experimental and the Control Groups

As is evident in figure 2, the same was true for homework anxiety. The mean scores for the experimental group in pretest, posttest, and follow up were 31, 14.88, and 15.77, respectively, and the mean scores for the control group were 29.5, 31 and 32, respectively.

To further examine the indexes of level, trend, and variability, figures were drawn separately for every student in both groups. It was observed that change in score magnitude (amount and direction) was indicative of the difference for all three students in the experimental group.

4. Discussion and Conclusions

The detrimental impact of anxiety on cognitive functioning, and hence academic performance, is well established. Prior research (Abazari, 2006; Ahadi, & Kakavand, 2005; Carroll, & Iles 2006; Cooray, & Bakala, 2005; Klomok & Kesern, 1994, as cited in Gorman, 2001; Marvian Hosseini, 1996; Nelson, 2011; Shapiro & Rich 1999; Silver, & Hagin 2002) has concluded that students with learning disabilities have high anxiety due to their problems and failures in learning and education. A vicious cycle develops, as their fruitless struggles to master academic tasks leads to a high level of anxiety, and the elevated anxiety becomes a major obstacle in successfully performing learning activities. High levels of anxiety have deleterious effects on different components of the information processing system, which results in inefficient information processing (Dadsetan, 2007; Gorman, 2001). Hence, the logical conclusion is that helping students with learning disabilities to reduce their homework anxiety will yield positive effects on their learning and performance. Muscular relaxation exercises help decrease anxiety and increase concentration. While loosening and tightening the muscles, the person pays attention to these contradictory states and concentrates on them. As a result, s/he experiences soothing and relaxing feelings with heightened levels of attention and concentration (Sahebi, 2001).

To answer the first research question, results indicate that all students in the experimental group improved significantly. The criterion was reduction of homework anxiety by one or more levels. Student 1 improved from medium-low to mild, and Students 2 and 3 both moved from medium-high to medium-low in homework anxiety. Although the results showed no significant change in control group, an ascending path was observed, which signifies the incremental nature of homework anxiety in LD students.

The multi-sensory exercises used in this study helped students in the experimental group improve significantly. The number of spelling mistakes of students 1, 2 and 3 were 15, 7.5 and 5.5, respectively, which indicates a considerable reduction. Multi-sensory methods combine students' sensory systems in the teaching process in order to reduce their learning problems. Mayer and Moreno (1998) found that learning outcomes are greater if the mixture of input is comprised of different modalities (e.g. visual and verbal),

and that conjoint processing of the splits of information between modalities enhances students' recall and comprehension (Mousavi, Low, & Sweller, 1995). This suggests that combined processing capability of students' modalities transcends the capability of either modality alone. Previous studies (Bahari Gharaguz & Seif Naraghi, 2006; Bara & Gentaz, 2011; Heidari, Hafezi, & Tahankar Dezfali, 2010; Hoefer, 2004; Mehrabizadeh Honarmand, 2003; Nader Hazeri, 2006; ShahniYeylagh, Karami, Shokrkon, & Riggs, 2008; Torgsenet, al. 1994; Williams, 2002) have shown positive effects of applying the multi-sensory method while working with students suffering from learning difficulties in general, and dysgraphia in particular.

Despite the shortcomings of the study, notably its lack of optimal control and the absence of two more experimental groups (each receiving only one intervention: VAKT or relaxation), the intertwined effect of the program simultaneously addressing learning and anxiety was the most outstanding finding. As is evident from the results, the program had a two-fold effect, which helped to break the vicious cycle: using the VAKT method helped to improve learning in writing and spelling, and relaxation helped to reduce anxiety, along with the compound effect which resulted in improved well-being and more efficient learning performance. The obtained results are promising in promoting learning and reducing anxiety problems to some extent. However, it is important to note that no single educational program can be applied for all students, as every student requires specific treatment depending on his/her capabilities and weaknesses. Although the positive effects of relaxation techniques are widely known, and VAKT activities are beneficial even for everyday learning, further research with a larger sample representative is needed to substantiate the compound effect.

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