

The Effect of Multi-Sensory Repetition on Students with Language Base Learning Differences in
U.S. History Course

by

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Abstract

The purpose of the study was to determine whether the use of multi-sensory repetition approach will have an impact on the academic achievement in the eleventh grade United States History II social studies class. The participants in the study included eighteen students that are diagnosed with language-based learning differences. The study was conducted on a unit covering the Spanish American War, using the first fifteen minutes of class to engage multi-sensory repetition approaches during a thirteen-day study. Participants were assessed using a pre-test/post-test design to compare the data before the intervention was administered and after the intervention was completed. The control group received standard drilling without a multi-sensory component. In addition to the pre and post test data, data were gathered on the percentage of absenteeism during the study. These data were then analyzed via the independent t test. Table 1 depicts the measures of central tendency. Table 2 depicts the independent t analysis. Thus, there was no impact that was statistically significant in terms of the intervention but there was a significant difference in absenteeism.

CHAPTER I

INTRODUCTION

Overview

“Learning disabilities arise from neurological differences in the brain structure and affects a person’s ability to receive, store, process, retrieve or communicate information” (Cortiella, 2014). National Center for Learning Disabilities collected data stating that learning disabilities are thought to be diagnosed as early as elementary age, during grades 1st through 4th. In 2013, out of 2.4 million American public-school students, five percent were identified with learning disabilities under Individuals with Disabilities Education Act (IDEA) (Cortiella & Horowitz, 2014). Often students with language-based learning differences struggle with comprehension, recall, reading or decoding, working memory and word retrieval. In particular language-based learning disorders refer to students with characteristics such as: executive function, dysgraphia, ADHD, anxiety performance, specific learning disability with impairment in reading, impairment in written expression, language receptive, language-expressive working memory, word retrieval, auditory attention, speed of information processing, metacognitive and self-advocacy skills and language formation disorder. Standard education is difficult for students diagnosed with a language-based learning disorder. Students with this type of disorder struggle to be successful in traditional classrooms.

In this study, the eleventh grade U.S. History II students will be studying the Spanish American War. This analysis was conducted to be a month-long trial to see the significances of multi-sensory learning for students with language-based learning differences, primarily dyslexia.

Students with language-based learning differences struggle to retain newly learned material on daily basis. Students diagnosed with dyslexia struggle with reading comprehension,

slow processing, and recall to information for an extended period of time, and not having the skills to be able to retain the information to succeed on exams and assessments. Multi-sensory integration approach, “Hannaford (1995) has made an excellent case for sensory integration model learning disorders: the brain’s management of neural activity that produces the higher-order cognition that we recognize as ‘learning’” (Prasannakumar, 2016, p. 629). As a special education teacher, the researcher saw firsthand how students with language-based learning differences struggle daily. After these students learn the information for an extended period of time, students have difficulties making strong connections to textbook information. It is difficult for students with language-based learning difference because they do not have the skills to be able to retain the information to succeed on exams and assessments.

This study examined several multi-sensory approaches to use in the classroom to help students engage with the lessons. Multi-sensory approaches force students to work together and interact with each other and it makes students apply what they have been learning in an academic setting to different contexts. Multi-sensory approaches bridge the gap between traditional lecture and hands-on experience through interactive pedagogy (Mobley & Fisher, 2014).

Statement of Problem

The purpose of this study is to examine if students with language-based learning difference benefit more from multi-sensory repetition than students who receive standard drilling.

Hypothesis

The study used the null hypothesis that eleventh grade U.S. History students that receive multi-sensory teaching will not improve cognitive memory versus standard drills.

Operational Definitions

The operational definition describes teacher-created assessments which include a pre-test and post-test on the effects of implementing multi-sensory repetition drills versus standard drills for the first fifteen minutes of class each day using interactive websites, videos, hands-on activities, visual components.

Quizlet: An online website that helps students memorize terms and people by making flashcards, interactive games and mock-up tests and quizzes. Student can later print these out to make flashcards that are hands-on.

Flashcard game: Students cut out Quizlet terms and historical people and glued them on flashcards. The definition is on one side and the term is on the other side. Students played against another classmate challenging them to a game of war using the terms.

Scribble Maps: An Internet-enabled geographic information system (GIS) and customizable map tool which allows students to label territories that were acquire during the roots of imperialism from 1867 to 1901.

VOX videos online: Informational videos online to teach students about the world around them and historical moments.

PowerPoint Presentation: A software product that uses slides and pages to create a visual, audio and interactive learning tool to create a presentation from Prentice Hall United States History textbook.

CHAPTER II

REVIEW OF THE LITERATURE

This literature review examines whether multi-sensory repetition benefits students with learning differences in the classroom. The study will include two different groups of students. Both groups of students will be learning about the Spanish American War with two different approaches. The first section of students will be the treatment group, which will be receiving the multi-sensory approach. During the first fifteen minutes of class the treatment group will be taught using PowerPoints, teacher made packets that include visual maps, rhythmic songs to help retain the information, interactive websites, and engaging videos. The second group of students will be receiving standard drilling during the first fifteen minutes of class time. During this time the students will be reviewing the information that was completed for homework to work on their short-term and long-term recall and retrieval of information. The students do this by typing answers 10 comprehension questions about the terms and people that were addressed in each chapter.

Defining Multi-Sensory in the Academic Setting

Multi-sensory learning integrates visual, auditory, tactile (touch) and kinesthetic (movement) learning elements. There are several styles of teaching methods that activate different parts of the brain (Rolfe & Cheek, 2012). Multi-sensory learning helps learners discover their learning style and the techniques that work best for their learning. Multi-sensory learning, as the name implies, is the process of learning new subject matter through the use of two or more senses (Scott, 1993) (Prasannakumar, 2016). “An old Chinese proverb that originated with Xun Kuand, a philosopher that lived from 312-230 B.C., is applicable: “Tell me, I forget, show me, I remember, involve me, I understand” (Stevens-Smith, 2016).

Nearly 90 years ago, Montessori initiated the multi-sensory learning movement (Katai, Toth & Adorjani 2014). Recent years, multi-sensory and multi-media have become synonymous with each other.

“Reflecting on terms like multi-sensory and multi-media we understand that the nearly 100-year-old multi-sensory movement has entered a new dynamic era (Katai, Toth & Adorjani 2014, p.227). “Revolutionary discoveries in neuroscience have resulted in new ways of thinking about the relationship between the sense and learning” (Katai, et al., 2014, p. 227). Recent research (Shaywitz, 2003) states that multi-sensory learning neurons are specific neurons in the brain that fire only when more than one sensory modality is activated by the environment (Katai, et al., 2014). These studies have shown that multi-sensory modality training is effective with students that have a language based learning difference. A multi-modal training program developed by a Finnish group has recently been shown to induce strong reading improvements in dyslexic children and adults (Kujala et al., 2001) as cited in (Kast, Meyer, Vogeli, Gross & Jancke, 2007). “The general movement and reflexes enable to exercise volunteer and adaptive motor control, subsequently developing also the posture control which ensures a base for the movement; after that, coordinated movements become possible” (Williamson & Anzalone, 2011) as cited in (Teodorescu & Popescu, 2014).

Understanding Your Learning Style

A ‘learning style’ can be seen as the characteristics of a learner that influences the way in which that person learns. The differences between individuals shape how they learn; as some prefer reflection while others need to see and practice their new skills. It is important for learners to understand their learning style so it may aid their ability to assimilate and accumulate new information (Rolfe & Cheek, 2012). Students who have learning disabilities face challenges

across subject areas due to deficits in organizational skills, higher-order thinking, working memory, retention and making connections (as cited in Alloway, 2011; Gurganus, 2007; Montague, Krawec, Enders & Dietz, 2013). Despite the success of various research-based academic interventions, many students with learning disabilities require additional help understanding how to assess their own level of comprehension as well as how to approach active engagement in learning (as cited in Montague, Warger, & Morgan, 2000 and Nagro, Hooks, Fraser & Cornelius, 2016).

A commonly used questionnaire for discovering preferred learning style is Fleming's VARK (visual, aural, read/write, kinesthetic). The four learning styles are: Visual/verbal (read/write) learning style, Visual/non-verbal (pictorial) learning style, Tactile/kinesthetic learning style, and Auditory/verbal learning style (Rolfe & Cheek, 2012). Visual/verbal learners are more efficient when presented with visual information in the form of written language (Rolfe & Cheek, 2012). Visual/non-verbal learners are most efficient when presented with visual information as a picture or illustration (Rolfe & Cheek, 2012). Tactile/kinesthetic learners are most efficient with a 'hands-on' learning style. Lastly, auditory/verbal learners benefit from information that is presented orally (Rolfe & Cheek, 2012). These learning styles are all different from each other; however, it is still important to use a multi-sensory approach as well since it has been proven to be the most effective way to teach any learner and uses all the different types of learning styles.

"The Dunn and Dunn model defines learning style as the way individuals begin to concentrate on, process, internalize, and retain new and difficult information (Dunn and Dunn 1993)" (as cited in Dunn, Doolan, Bostrom, Russo, Schiering & Tenedero, 2009). In 2009, a new multi-sensory method was introduced to improve the teaching-learning of recursive algorithms.

This method explores the visual, auditory and kinesthetic sense of students, helping them to imagine abstract concepts and processes (Katai, 2014). The Dunn and Dunn model focuses on the classrooms atmosphere (i.e. temperature, lighting, seating arrangements and sounds). The inhibitors that students feel comfortable in their surroundings help them to focus and process the information given to them. The physiological elements (i.e. auditory, visual, tactual, and kinesthetic) engages students in the learning process to retain and recall short-term and long-term information.

Incorporating Multi-Sensory in the Classroom

Special educators are increasingly using multisensory environments even though there is a lack of evidence for their effectiveness as an educational intervention (Stephenson, 2002). “A multisensory environment which may comprise suites of rooms, a single room or a designated area within a larger space, are collections of objects and equipment that are designed to provide sensory stimulations” (Houghton et al. 1998; p. 268). Multisensory rooms have “become all the rage in special schools” (Houghton et al. 1998; p. 268), their use must be regarded as an educational intervention. Pagliano (1999) noted that although educators are using the rooms, little is known about how they are used. There are very few studies of educational outcomes from interventions based on multisensory rooms (as cited in Glenn, 1996 and Houghton, 1998). In 1998, Martin commented that many of the studies evaluating that the use of multisensory rooms were anecdotal and descriptive, some studies were poorly designed and provided no control conditions, and more carefully designed studies did not provide convincing evidence to support the benefits of multisensory rooms as a treatment (Stephenson, 2002).

The Academy in Manayunk (AIMS Academy) has embraced multi-sensory learning to the fullest ability by interweaving thematic concepts throughout their literature, writing, and

enrichment activities (Herman, 2010). The academy has a Cave Club which is made for the younger students. In The Cave Club, 1st and 2nd grade students dress as cave men and they learn about the earliest man, dinosaurs, general science and anthropology through acting the time period out themselves (Herman, 2010). “As the grades increase the role play and art continue to serve as the central point of the curriculum but in a more sophisticated and mature way” (Herman, 2010). Positive outcomes have come from performance. This way of learning helps to engrain the information into the students’ minds, rather than if they were just reading the information from a textbook or listening to the teacher speak.

“Geographical fieldwork in schools and universities are being strengthened through creative and energetic innovations in teaching and learning” (Cook 2011; Phillips & Johns, 2012) (as cited in Phillips, 2015, p. 617). Jean Jacques Rousseau in *Emile: or, Concerning Education*, this curiosity-driven learning begins with experience, which can be sparked by stepping outside the classroom (Phillips, 2015). “Seeing and touching something as simple as a stone, a young person may become curious, framing questions about the world then refining and attempting to answer the questions, these fundamental principles provide a rationale for field-based learning” (Phillips, 2015, p. 617). Pedagogical philosopher Mark Zuss elaborates on the relationships between sensory stimulation and curiosity, which he describes as “thought’s freedom” (Zuss, 2012, p. 91). He argues that thoughts freedom can and ideally should be free ‘ranging, adventurous, playful and transgressive, within a particular spirit, which revolves around questioning rather than subversion for its own sake. “How is it,” he asks, “that, like small flames, questions arise from the filaments of our senses?” (Zuss, 2012, p. 122) (as cited in Phillips, 2015, p. 619).

College classrooms are now finding that multi-sensory and kinesthetic learning activities are becoming very beneficial. For college students, research (Kuh, 2008) shows that interactive experiences such as “internships and learning communities can have a profound influence on the quality of college education” (as cited in Mobley & Fisher, 2014). “One reason these “high-impact educational practices” (Kuh, 2008) are so successful is that they force students to interact with others and they ask students to apply what they have been learning in an academic setting to different contexts” (Shams & Seitz, 2008). It is quite evident that is difficult to replicate an internship experience in the classroom, there is still a gap that can be built between traditional lecture and hands-on experience through interactive pedagogy (Shams & Seitz, 2008). Although some college-level instructors have interactive classrooms, professors tend to limit interactive lessons to multi-day activities clustered at the end of the semester (Shams & Seitz, 2008). “Kinesthetic learning can range from students rotating around the room as planets to illustrate planetary motion,” however the more multi-sensory learning used in a college classroom helps to instill the information into the students’ memory (Shams & Seitz, 2008).

Benefits of Multi-Sensory

There are several benefits to multi-sensory learning. Studies of learning and in particular perceptual learning have focused on learning of stimuli consisting of single sensory modality, however our world involves constant multi-sensory stimulation (Shams & Seitz, 2008). For example, suppose an adult individual wants to learn to discriminate a variety of bird species. Most adults would approach this by researching different bird species through pictures, video clips, or types of birds labeled with the name of the species. The learning could be easier and more efficient if the training combined the images with the sound of the birds. Because bird songs add another feature that can be used to distinguish the different species. Training the

multisensory route (auditory and visual) stimuli still be beneficial if the ultimate goal of learning is to visually discriminate them. (Shams & Seitz, 2008).

“Multi-sensory interactions are ubiquitous in the nervous system and occur at early stages of perceptual processing” (Shams & Seitz, 2008, p.411). There have been reports of multi-sensory interactions in various perceptual tasks and settings that indicate these interactions are the rule rather than the exception in human processing of sensory information (Mobley & Fisher, 2014). There has been evidence that multi-sensory exposure has enhanced reinforcement learning (Mobley & Fisher, 2014). When involving students moving around in the classroom and/or acting out lessons, students who normally do not participate verbally still have to place themselves on the spectrum and talk with classmates around them to determine if they are in the correct place. Students who are up moving around are drawn away from being glued to their laptops or notes and forced to form their own opinion, or at least hear other classmates and engage in discussion (Mobley & Fisher, 2014).

Multi-sensory modalities are an effective teaching tool for any age group, ranging from early education to adulthood. There is a wide range of different multi-sensory and kinesthetic activities that can be used in the classrooms. “The results presented here demonstrate that multisensory training can be more effective than similar unisensory-training paradigms (Shams & Seitz, 2008).

CHAPTER III

METHODS

Design

The purpose of this study is to observe the impact of using multi-sensory repetition drills in the classroom with eleventh grade students that are diagnosed with a language-based learning differences. As well as, determine the impact that multi-sensory repetition drills have on students with varying language-based learning differences versus standardized drills.

A pre-test/post-test quasi-experimental design to compare multi-sensory repetition drills to standard drill was used in this study. The students studied a unit on the Spanish American War. The treatment Group A will be the second period eleventh grade class will receive the multi-sensory repetition drill for the first fifteen minutes of class. The control Group B will be the third period eleventh grade that will receive standard drills the first fifteen minutes of class.

Participants

The participants in this study includes seven female students, age seventeen years old. As well as ten male students, ages seventeen and eighteen years old. These students attend a specialized education high school in Baltimore County, Maryland that services students with language-based learning differences. These students' learning profiles are diagnosed with the following learning differences: ADHD, dyslexia, dysgraphia and anxiety disorder. Students with these disorders struggle with decoding, comprehension, anxiety, executive function, working memory, metacognitive and self-advocacy skills, and word retrieval.

Additionally, participants require medications that impacts their school performance.

Instrument

The instruments used for the assessment included a pre-test and post-test with 25 multiple choice questions that the students completed online through *Blackbaud* (an online platform that gives the educator the opportunity to deliver videos, documents, and assessments through the computer). An additional *Quizlet* test was given which included terms and people with ten matching questions, ten multiple choice questions. The researcher will document the days that the students missed and the material covered the day that they missed. The researcher will also check with the school nurse to make sure they are on their daily medication during this one-month study. The researcher designed an assessment that tests the students' knowledge on the Spanish American War.

	A	B	C	D	E	F	G
1	Students U.S. History II	Group 1= Treatment; Group 2=Control	Pre-Score	Post Score	Gain Score	Attendance: days out of days	Medication
2	Student 1		1				
3	Student 2		1				
4	Student 3		1				
5	Student 4		1				
6	Student 5		1				
7	Student 6		1				
8	Student 7		1				
9	Student 8		1				
10	Student 9		2				
11	Student 10		2				
12	Student 11		2				
13	Student 12		2				
14	Student 13		2				
15	Student 14		2				
16	Student 15		2				
17	Student 16		2				
18	Student 17		2				

Procedures

During the time of this study there will be two different groups. Treatment Group A will be receiving multi-sensory repetition approaches for the first fifteen minutes each day for a month lessons (i.e. PowerPoints, videos, interactive websites, visual components, Quizlet and flashcard games). The class will begin during the first fifteen minutes by taking a hands-on, visual and kinetic approach to help the students with their memory to retain the information. Some of these hands-on activities included visual maps, for example the U.S Imperialism World Map that the students used colored pencils and pencils to visually show the territories that were occupied by the United States during the Spanish American War and between the late 1800s and 1900s. The students were able to access through *Blackbaud* a visual diagram of the attributes of Imperialism. The Control Group B will be receiving the first fifteen minutes of each class with standard drills (i.e. comprehension questions, reviewing terms and people, vocabulary review, reading chapters at home) approach to help the students with their memory to retain the information. The Control Group B was designed to be ran like a college lecture that received strictly textbook material. The results will be determined based off of the results from the pre-test/post-test. For example, did the students who received the multi-sensory approach increase their test scores from the pre-test/post-test more than the students who received standard drill?

CHAPTER IV

RESULTS

Analysis of the Data

The purpose of this study is to observe the impact of using multi-sensory repetition drills versus standardized drills in the classroom with eleventh grade students that are diagnosed with a language base learning differences.

The pre and post-test data were gathered from 18 students. The pre and post-test were identical, which consisted of 25 multiple choice questions through *Blackbaud*. An additional 20 questions on terms and people that was given through *Quizlet*. There was significant time frame between the pre and post-test that were given to ensure the students were not able to memorize the information from the pre-test.

In addition to the pre and post test data, data were gathered on the percentage of absenteeism during the study. These data were then analyzed via the independent t test. Table 1 depicts the measures of central tendency. Table 2 depicts the independent t analysis.

Table 1

Measures of Central Tendency

Group 1= Treatment		N	Mean	Std. Deviation
Group 2= Control				
Gain Score	1	8	24.00	11.180
	2	9	22.17	15.880
Absent	1	8	.2112	.10063
	2	9	.0767	.08500

Table 2

Independent t test

		t	df	Sig. (2-Tailed)	Mean Difference
Gain Score	Equal variances assumed	.272	15	.790*	1.833
Absent	Equal variances assumed	2.990	15	.009**	.13458

* $p > .05$ not statistically significant

** $p < .05$ statistically significant

Thus, there was no impact that was statistically significant in terms of the intervention but there was a significant difference in absenteeism.

CHAPTER V

DISCUSSION

The purpose of this study was to observe the impact of using multi-sensory repetition drills versus standardized drills in the classroom with eleventh grade students that are diagnosed with language-based learning differences. Two groups of eleventh grade students received two different approaches. Group A received a multi-sensory approach. Group B received standard drilling. Neither group differed significantly in either the pre or post-test in total scores. The null hypothesis in this study was supported because there was no statistically significant difference in the total scores between Group A and Group B. There was a statistically significant difference between the groups on absenteeism.

Threats to Validity

All research studies suffer from two threats to validity. Namely, threats involving external validity and internal validity. External validity deals primarily with the type of sample and how it is drawn. Whereas, internal validity deals with how the research was conducted and the decisions that were made. The participants in the study was a small group (n=18), and students were frequently absent for numerous days of class which affected the outcome of the study. Due to spring break the students had a two-week break, the one-month study was held over thirteen days. Only four students were there for the full thirteen days of the study, three students attended twelve days of the study, five of the students attended eleven days of the study, three students attended ten days of the study, one student attended nine days of the study and one student attended eight days of the study. The study could have been more effective if the two-week spring break did not happen to cross over the one-month study period. In addition to the

interruption by spring break, one of the subjects missed several days and the end of the study due to medical leave which resulted in the removal of the student from the study.

One of the threats to internal validity during the research process was testing. The students were given a pre-test. Taking a pre-test can alter the results of the post-test because students may benefit from the ability to retrieve pre-test information from short term memory. A second threat that occurred was mortality, which is when a student drops out of the experiment before it's completed which then alters the composition of the treatment groups. One student in Group A had to leave due to medical leave and was not able to return before the study was completed. The student was ultimately thrown out of the study. A third threat that occurred was resentful demoralization. This occurred when Group B realized that they were not receiving the same treatment as Group A. The researcher had to inform the study's participants and their parents of which group would be receiving what treatment. Group A received a more hands-on learning experience as Group B received more of a college based lecture approach

Relationship of The Findings of This Study to Previous Research

The focus of the research study was to determine if a sample of eleventh grade students, who are diagnosed with language-based learning differences, would retain more cognitive information if they received multi-sensory repetition drills in compared to those who received standardized drills. A result of addition of kinesthetic learning in college classrooms has found that multisensory and kinesthetic learning activities are becoming very beneficial. For college students, research (Kuh, 2008) shows that interactive experiences such as “internships and learning communities can have a profound influence on the quality of college education” (as cited in Mobley & Fisher, 2014, p.301). The researcher found that the students were more engaged and interacted more with the researcher and their peers during in the multi-sensory

repetition activities. Students seemed to be fully engaged in the lesson at hand. “One reason these “high-impact educational practices” (Kuh, 2008, p. 301) are so successful is that they force students to interact with others and they ask students to apply what they have been learning in an academic setting to different contexts” (Shams & Seitz, 2008). Although some college-level instructors have interactive classrooms, professors tend to limit interactive lessons to multiday activities clustered at the end of the semester (Shams & Seitz, 2008). “Kinesthetic learning can range from students rotating around the room as planets to illustrate planetary motion,” however the more multisensory learning used in a college classroom helps to instill the information into the students’ memory (Shams & Seitz, 2008). Several studies stated in their conclusions, that multisensory approach is not more effective than other standard approaches.

Summary and Conclusions and Directions for Future Research

The results of this study imply that future research and investigation should be conducted on the effect of multisensory teaching. This study did not have strong results and/or prove that students with language-based learning differences learn better or comprehend more when they are exposed to multi-sensory instruction. The researcher’s results did determine that the students comprehended some information given more than those who were taught through standard drilling. However, it is not enough evidence to determine that multisensory instruction has a definite greater effect on students with language-based learning differences. Researchers stated that future studies need to be conducted to prove the benefits of multisensory instruction on assessments. There were numerous threats to validity that could be done differently for future studies. The sample utilized was a small group the researcher selected. Both groups of students have language-based learning differences with some more severe than others. However, the researcher did not use each student’s specific learning accommodations, for example extended

time on assessments. The students for both Group A and Group B represented a convenience sample, due to the accessibility that was available to the researcher. A threat to the study that has already been discussed was that both Group A and B received 15 minutes of daily drills reviewing the material covered the day before, during the thirteen-day study. Both groups covered the same material and were given the same pre and post-test. The test was given with a specific time limit, approximately 42 minutes. However, the reliability and validity of the results could be affected by some students that use Word Q online software. Word Q is an audio reader that specific students use to have the test/quiz orally read to them. The researcher did not give directions to the students as far as if they could or could not use Word Q during the pre/post-test. The researcher could have used a better assessment through Mental Measurements Yearbook by using Cooperative American History Test. While the eleventh-grade students in the multi-sensory group did not make a significant gain in relation to those in the standard drilling group, it is not possible to conclude multi-sensory repetition is or is not definitely more beneficial than standard drilling.

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