2022

The Use Of Musical Mnemonic Devices In The Aid Of Short-Term And Long-Term Memory Recall

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THE USE OF MUSICAL MNEMONIC DEVICES IN THE AID OF SHORT-TERM AND LONG-TERM MEMORY RECALL

A Dissertation

Presented to

The College of Graduate and Professional Studies

Department of Teaching and Learning

Indiana State University

Terre Haute, Indiana

In Partial Fulfillment

of the Requirements for the Degree

Doctorate in Philosophy in Curriculum and Instruction

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by

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May 2022

Keywords: mnemonic, music, memory, short-term, long-term

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ABSTRACT

Mnemonic devices, through song, spoken rhymes, or advertisements, have been shown to help people recall information. Good teachers seek out tools and strategies that will help their students to perform better on tests and to learn and retain information better. This study aims to provide further evidence that utilizing the creative teaching method of packaging important concepts and definitions into a longer, recognizable pop song can aid college students in short-term and long-term memory recall of certain pieces of information. The data for this study were collected from students in four Introduction to Business courses at a large Midwestern university. Participant either listened to a mnemonic-like song covering information on marketing or were read a summary of the same information. A researcher-created test was then administered to the participants after three exposures to the material and again two weeks following the initial administration. Results indicated that in this study the use of a pop song parody as a mnemonic rehearsal technique was not significantly effective in encoding information to long-term memory, as measured two weeks following the initial test, compared to no memory aid. Results of this study indicated that the pop song parody used as a mnemonic rehearsal technique did not appear to aid in recalling information two weeks after instruction versus at the point of instruction. Results of this study also indicated a significant difference in a subject's ability to recall information when presented as a single versus repeated exposure in the musical mnemonic.These results indicated that the repeated exposure material was more effectively recalled than the single exposure material. Finally, the results indicated that instrumental musical experience did not significantly affect a participant's ability to recall information when a musical mnemonic was used in instruction. Songs used as mnemonic-like songs have the potential to aid students' ability to recall information both in the short term and long term. However, the research would support that songs need to meet certain conditions in order to ensure that the cognitive load is not too high and that students have the opportunity to rehearse these songs actively. If these conditions are not met, it is very likely that the mnemonic-like song will likely not aid students in their ability to recall information, and it may hinder this ability, especially over time.

PREFACE

What follows is the dissertation “The Use of Musical Mnemonic Devices in the Aid of Short-term and Long-term Memory Recall. It has been written in partial fulfillment of the requirements for the doctorate in philosophy in curriculum and instruction degree at Indiana State University.

This project comes from a desire to incorporate my background in music into general education courses. As a band director for over a decade, I have personally seen my own middle and high school students use the music we were rehearsing for concerts as a framework for studying for tests in other subjects. Students would either use the music as background noise or would add lyrics to the music as a study aid. My wife and I would also spend long car trips making up silly lyrics to old 90’s songs just to pass the time. What interested me through this was that it seemed to work in helping students and myself to retain the information. This research line comes out of a desire to test the technique and to attempt to understand how to improve it.

This work would have been impossible without the tireless work and help of my dissertation committee at Indiana State University. Also, no major endeavor like this comes to fruition without the unwavering support of my family.

ACKNOWLEDGMENTS

I want to thank each member of my committee for their guidance through this process and study. I thank my beautiful wife, Sara, for all of her hard work and support. Thank you for putting up with all of the long nights, missed meals, and absences while I worked on everything. You did nothing but amaze me with everything you did at home and in our lives. I love you. I thank my wonderful children, Ty and Taj, for inspiring me to be the best person I could ever hope to be. I thank my parents, in-laws, friends, and family who have supported me in this endeavor. Each one of you inspired me in ways you may never know, and I am eternally grateful for everything.

I did it dad!

TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

Most students in elementary or middle school are required to go through the process of learning all 50 states. Many students learn through singing a song that not only teaches them the states but does it in alphabetical order. A popular children's cartoon in the 1990s took this strategy one step further. In the show, a gameshow host asks a character named Wakko to name all 50 states and their capitals (Mills & Fleischer, 1993). The character uses the same tune many students learned for reciting the states in order. Many adults today can still recite the states in order years after being taught them in school. This use of a mnemonic-like song appears to be a popular teaching strategy in elementary and middle school settings (Mastropieri et al., 2000). However, this strategy seems to be used less frequently as a teaching strategy for older students.

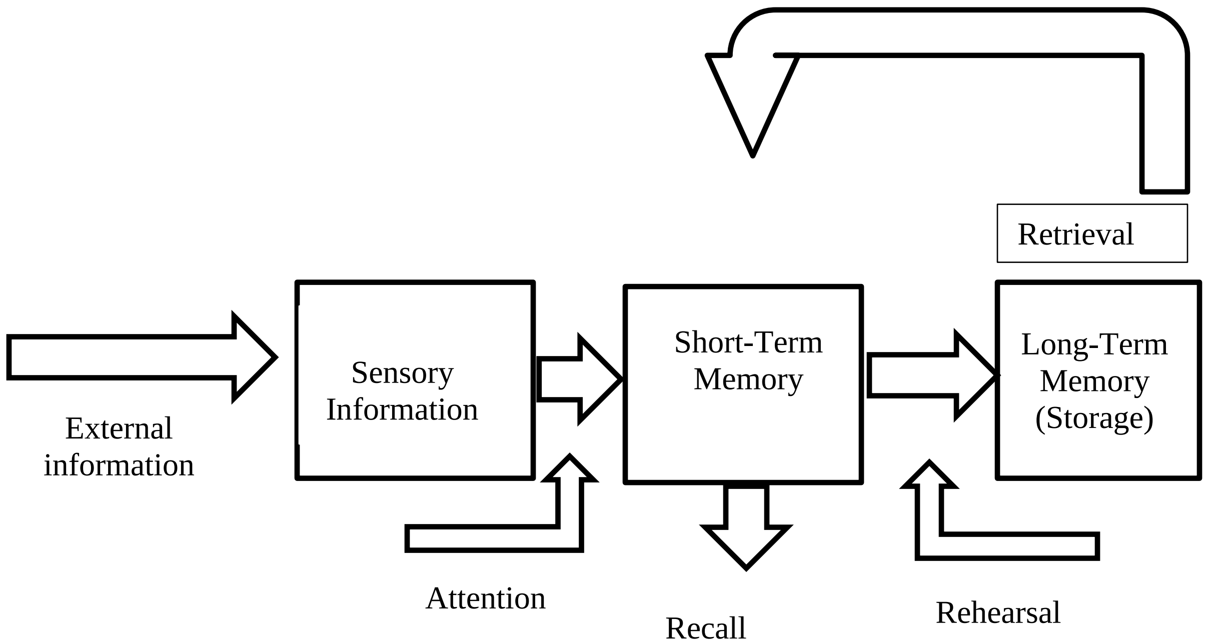
Mnemonic-like songs are a substantial part of our everyday lives, mainly through advertising, we are often unaware that we are even learning the songs. Radio advertisement and television commercial jingles often repeat the telephone number required ad nauseam. The music and its accompanying text can be labeled a collaborative sign (Alexomanolaki, 2006).Alexomanolaki defines a collaborative sign in advertising as something that not only reinforces what the advertisement is about, but it also focuses the listener’s attention on the essential aspects of the advertisement.

Music can also be a retrieval cue for recalling vital information. Marketers and advertisers have discovered the power of mnemonic-like songs in their campaigns to help ensure that consumers remember the information presented. It only seems logical that this type of presentation strategy would be helpful for students in educational settings beyond the lower grades as well.

Cognitive psychologists use the following theoretical framework for how human memory works: (1) information is received, (2) information is retained, (3) information is retrieved (Sutton et al., 2010). Atkinson and Shiffrin (1968) developed an influential model (see Figure 1) explaining this process that has become the basis for contemporary cognitive models of memory. According to their model, information is perceived in great detail in sensory memory. From there, the information that was attended to moves to short-term memory, where the information can be recalled for about 15 to 20 seconds without active rehearsal of the information (Ormrod, 2020; Sutton et al., 2010). Some of this information may be encoded through active rehearsal into long-term memory, where it may remain as a permanent fixture for later retrieval (Ormrod, 2020; Sutton et al., 2010). Active rehearsal may include repetition or continued exposure to the information.

Figure 1

The Model of Memory



*Note.*This model was described in Richard C. Atkinson and Richard M. Shiffrin, "Human Memory: A Proposed System and Its Control Processes," in *The Psychology of Learning and Motivation,* ed. Kenneth W. Spence and Janet T. Spence (Academic Press, 1968), 89-195.

Generally, two types of memory are utilized in the recall of information: explicit and implicit. Explicit learning occurs when a person consciously attempts to learn a new concept or skill (Dowling et al., 2001; Ormrod, 2020; Schacter, 1987). Implicit learning happens due to repetition that results in muscle memory, repeated previous experiences, or other, non-conscious reasons (Ormrod, 2020). A person may not even realize that he or she is recalling the information needed when implicit learning occurs. Examples of activities that can be performed without conscious thought may include driving a car, playing a musical instrument, and riding a bike (Ormrod, 2020; Snyder, 2000).

When perceived, information first enters our short-term memory, where it remains for an average of three to five seconds (Ormrod, 2020). Information that is not rehearsed is forgotten. If the information is rehearsed, it may enter long-term memory. The information is then organized with other bits of information in order to associate it with previous experiences and knowledge (Ormrod, 2020). Interestingly, this transfer of information from short-term to long-term memory does not require consciously examining or working with the information (Ormrod, 2020; Snyder, 2000). Therefore, the use of repetition in advertising may facilitate the transfer of information from the short-term to long-term memory in an implicit fashion. If this is the case, then the power of repetition has significant potential implications in the classroom as well.

Need for the Study

Many studies outline the viability of the use of mnemonic devices by way of commercial jingles and indicate that the use of songs may significantly aid in short-term and long-term memory recall (Alexomanolaki et al., 2010; Krishnan & Shapiro, 1996; Pham & Vanhuele, 1997; Shapiro & Shanker, 2001; Weilbacher, 2003; Zaltman, 2003). Unfortunately, most of the research available at this time involves short musical examples (Moore et al., 2008; Wallace, 1994), subjects with mental disabilities (Moore et al., 2008; Peretz et al., 2004; Thaut et al., 2014), or lists of random words rather than information needed to succeed in a class (Balch et al., 1992; Rainey & Larson, 2002; Smith, 1985). This study aims to provide further evidence that utilizing the creative teaching method of packaging important concepts and definitions into a longer, recognizable pop song can aid college students in short-term and long-term memory recall of certain pieces of information.

Problem Statement

Teachers should expose students to a wide array of teaching strategies aimed at providing them with ways to learn, remember, and recall information (Ormrod, 2020). Students in academic settings are having difficulty recalling information taught to them in traditional lecture pedagogy (Ormrod, 2020). By utilizing mnemonic devices, students may be able to remember and recall information more easily.

A mnemonic device is something intended to assist the memory, such as a verse or formula (Merriam-Webster, n.d.). Mnemonic devices appear to aid subjects in recalling information within a short timeframe (Alexomanolaki, 2006; Alexomanolaki et al., 2007; Baddeley, 1986, 1990; Dowling et al., 1995; Dowling et al., 2001; Ebbinghaus, 1885; Mehler & Carey, 1967; Ormrod, 2020; Sachs, 1967; Waugh & Norman, 1965). Research also indicates that the ability to recall information declines significantly over time (Atkinson & Shiffrin, 1968; Ormrod, 2020; Sutton et al., 2010). However, this does not appear to be the case when the information is paired with music (Dowling et al., 1995; Tillmann & Dowling, 2007). If music can aid the recall of information over longer periods of time, and mnemonic devices can aid the recall of information over short periods of time, pairing the two together could aid in the overall ability to recall information both in short-term and long-term. Little research has been performed on the effects of pairing mnemonics with music.

Purpose Statement

The purpose of this study is to examine if the use of a popular song with rewritten lyrics used as a mnemonic device is more effective in aiding students' recall of information than traditional lecture delivery.

Research Questions

The following research questions will guide this study:

1) Was using a pop song parody as a mnemonic rehearsal technique more effective in helping students correctly name more of the “4Ps” (product, price, place, promotion), define more of the 4Ps, and correctly name more of the six environmental forces (political, economic, sociocultural, technology, environmental, and legal), 6Fs, than the control group taught more traditionally?

2) Did the pop song parody used as a mnemonic rehearsal technique aid in recalling information two weeks after instruction versus at the point of instruction?

3) Is there a significant difference in a subject’s ability to recall information when it is presented in either a single or repeated exposure to the musical mnemonic?

4) Does instrumental musical experience significantly affect a subject’s ability to recall information when a musical mnemonic is used in instruction?

Significance

If this study indicates that the use of mnemonic devices is a more effective method of aiding memory recall than traditional lectures, the pedagogy of many classes in nearly every field could be altered to reflect this finding. Music in the classroom could become a more widespread tool than currently used. Students may discover a tool that allows them to recall more copious amounts of information more accurately than previously used strategies did. Teachers could potentially shorten the amount of time needed to cover, re-cover, and re-cover again the material that they wish for students to be able to recall quickly. The use of musical mnemonics could also allow them to teach more material in their classes, thus allowing students to progress further in the content than previous teaching strategies allowed. Studies also indicate that the brain’s ability to recall information declines over time unless music is paired with that information (Dowling et al., 1995; Tillmann & Dowling, 2007). This finding could allow for students and teachers to develop a better way to recall important information over longer periods of time.

Limitations

This study did not control for socio-economic or any other outside influences on the participants that have been shown in previous research to impact academic achievement. The feasibility of gathering information concerning the subjects is not practical for this study. This study will not control for students in separate sections of the Introduction to Business classes communicating with each other regarding the song used in the study. While it would be ideal if the participants in the treatment groups would not communicate with students in the control groups, it is not feasible to control for this potential influence. In an attempt to control for this, the participants will not have access to the audio recording of the song. This will help to control for participants sharing the song or listening to it outside of class.

This study will use four sections of Introduction to Business. Three professors teach the classes, with one professor teaching two of the four sections. This schedule will allow for one professor to have both a control and experimental group. This design will also help control the influence of participants sharing the song with other participants as two separate professors and sections of participants will experience the treatment.

Delimitations

This study only uses first-year business students from one Midwestern university. The access availability of the participants created this delimitation. This study will also only utilize one pop song as chosen by the researcher. The song was specifically chosen because of its form (AABA). This form allows for more complex information to be presented three times, while list recall information is only presented once. This song may affect the generalizability of the results as not all mnemonic devices or songs utilize an AABA form.

Operational Definitions

Short-term memory

Short term memory is generally thought of by theorists as lasting anywhere from 30 to 60 seconds (Ormrod, 2020). The current study operationally defined short-term memory as the ability for students to recall information immediately following the playing of a mnemonic-like song or the reading of a review.

Long-term memory

Long-term memory duration is often not agreed upon by theorists. Some believe that once information enters long-term memory it remains there permanently and that forgetting the information is simply a retrieval problem (Ormrod, 2020). Others believe that long-term memory is only as long as a person rehearses the information. While long-term memory is generally considered to be a substantial length of time, its actual measured length is something that will likely remain a mystery. The present study operationally defined long-term memory as the ability for participants to recall information two weeks following the first administration of the user created test.

Summary

Mnemonic devices in the form of jingles and short melodies appear in our lives on an almost daily basis. Cartoons (Mills & Fleischer, 1993) and radio and television commercials (Alexomanolaki et al., 2010; Pham & Vanhuele, 1997; Shapiro & Shanker, 2001; Yalch, 1991) use these devices to entertain and in hopes that the listeners and viewers will retain the information presented within them. Researchers have developed models (Atkinson & Shiffrin, 1968; Ormrod, 2020; Sutton et al., 2010) of how people process and retain information that seem to coincide with how media professionals design their programs to help consumers retain the information.

Studies have indicated that subjects' abilities to recall information may decline over time (Tillmann & Dowling, 2007; Waugh & Norman, 1965) or when added information is presented between the initial presentation of information and the need to recall that information (Waugh & Norman, 1965). In contrast, the same decline in recall does not appear when music is being recalled (Dowling et al., 1995; Tillmann & Dowling, 2007). Marketers and advertising agencies have conducted studies indicating unconscious reactions to their advertisements more accurately predict consumer behaviors than surveys and reports that consumers consciously provide (Alexomanolaki et al., 2010; Pham & Vanhuele, 1997; Shapiro & Shanker, 2001; Yalch, 1991). This study will pair a mnemonic device with a popular song in order to ascertain if the use of this type of memory aid helps subjects in the recall of information both in short time frames (within one class period) and in longer time frames (two weeks later). The design will use control and treatment groups from Introduction to Business courses at a large Midwest university.

CHAPTER 2

REVIEW OF LITERATURE

Research has shown how students can process information through cognitive load and working memory (Baddeley, 1986; Chase & Simon, 1973a; Cowan, 1988, 2001; De Groot, 1966; Miller, 1956; Ormrod, 2020; Paas et al., 2003; Peterson & Peterson, 1959; Sweller, 1988). Studies have also examined how time can affect short-term memory recall and recognition (Alexomanolaki, 2006; Alexomanolaki et al., 2007; Baddeley, 1986, 1990; Dowling et al., 1995, 2001; Ebbinghaus, 1885; Mehler & Carey, 1967; Ormrod, 2020; Sachs, 1967; Waugh & Norman, 1965), and how short-term memory recall is affected by interference from other information (Baddeley, 1986, 1990, Gernsbacher, 1985, 1990; Kintsch, 1994; Kintsch et al., 1990; Ormrod, 2020; Tillmann & Dowling, 2007; van Dijk, 1983; Waugh & Norman, 1965). Also, the field of marketing and advertisement has seen much research with regard to music and images aiding in memory recall (Alexomanolaki et al., 2010; Krishnan & Shapiro, 1996; Pham & Vanhuele, 1997; Shapiro & Shanker, 2001; Weilbacher, 2003; Zaltman, 2003). Researchers have also examined the role of music in aiding memory recall (Balch et al., 1992; Besson et al., 1998; Calvert & Tart, 1993; Peretz et al., 2004; Rainey & Larsen, 2002; Serafine et al., 1984, 1986; Smith, 1985). This review of literature aimed to put into perspective the relevant findings with regard to music as an aid in short- and long-term memory recall.

Cognitive Load Theory and Working Memory

According to British professor Dylan Williams, cognitive load theory is the single most important thing for teachers to know (NSW Department of Education, 2017). As noted in the previous chapter, cognitive psychologists use the following theoretical framework for how human memory works: (1) information is received, (2) information is retained, (3) information is retrieved (Sutton et al., 2010). Atkinson and Shiffrin (1968) developed a very influential model (see Figure 1) explaining this process that has become the basis for contemporary cognitive models of memory. According to this model and theory, information is perceived in great detail in sensory memory. From there, the information which was attended to moves to short-term memory where that information can be recalled for about 15 to 20 seconds without active rehearsal of the information (Ormrod, 2020; Sutton et al., 2010). Some of this information may be encoded through active rehearsal into long-term memory, where it may remain as a permanent fixture for later retrieval (Ormrod, 2020; Sutton et al., 2010). Active rehearsal may include repetition or continued exposure to the information with attention being paid to the information.

Cognitive load theory is a theory of how much information the brain can process while working to solve a problem (Paas et al., 2003; Sweller, 1988). It emerged in the 1980s and 1990s under psychologist John Sweller and colleagues (NSW Department of Education, 2017). Cognitive load theory asserts that there is a limit to how much new information the brain can process at one time and that there are no known capacity limits to how much information the brain can store. The theory holds that the human brain has a short-term working memory that is limited in capacity to 4 ± 1 pieces of information (Baddeley, 1986; Barrett et al., 2004; Cowan, 2001; Miller, 1956; Ormrod, 2020) and a limited duration of approximately 30 seconds (Cowan, 1988; Ormrod, 2020; Peterson & Peterson, 1959) when dealing with new information. According to Sweller et al. (1998), “The implications of working memory limitations on instructional design can hardly be overestimated . . . anything beyond the simplest cognitive activities appears to overwhelm working memory. Prima facie, any instructional design that merely ignores working memory limitations inevitably is deficient” (pp. 252–253).

Cognitive load divides into three types of loads: intrinsic, extraneous, and germane (NSW Department of Education, 2017). Intrinsic cognitive load refers to the difficulty of the subject matter encountered by the learner (NSW Department of Education, 2017; Sweller, 1994, 2010; Sweller & Chandler, 1994). The complexity of the material and the prior knowledge of the student also play a role (NSW Department of Education, 2017; Sweller et al., 1998). Theorists suggest that instructional techniques should involve the teacher in altering the instruction to fit the level and prior knowledge of the student (NSW Department of Education, 2017). Teaching that introduces material in a way that moves from the simple to the complex may significantly help a learner deal with the intrinsic cognitive load, and, thus, grasp the material more efficiently.

Extraneous cognitive load refers to how the information is presented to the learner (NSW Department of Education, 2017; Sweller et al., 1998). In other words, is the material taught in a manner in which learners' attention is explicitly focused on what they are to be learning with much of the background or distracting materials left out (NSW Department of Education, 2017)? In this manner, learners can focus their attention on the intrinsic cognitive load and, thus, grasp the material more efficiently.

Germane cognitive load refers to the process of transferring information into long-term memory (NSW Department of Education, 2017; Sweller et al., 1998). In other words, this is where long-term learning takes place. The three types of cognitive load are thought to be additive, and, thus, teachers must design instruction in a manner in which the extraneous load is minimized while the germane load is maximized (NSW Department of Education, 2017; Paas et al., 2003; Sweller et al., 1998).

Cognitive load theorists have produced many different types of instructional design strategies in order to maximize germane cognitive load and minimize extrinsic cognitive load (NSW Department of Education, 2017). These include the worked example, expertise reversal, redundancy, split attention, and modality.

The worked example involves the teacher providing the learner with an example of a problem that is already solved with all of the steps written out for the learner (Cooper & Sweller, 1985, 1987; NSW Department of Education, 2017). Research in this technique has shown that novice learners perform better on subsequent tests when provided with worked examples than those who must figure out the solution for themselves (Cooper & Sweller, 1985, 1987). This result is due to the decreased load on the working memory. However, the expertise reversal strategy is the reverse of the worked examples strategy. This strategy becomes more effective once the learners move from novice to advanced in the subject area (Leslie et al., 2012; Pachman et al., 2013; Yeung et al., 1998). At that point, the worked examples strategy appears to have little effect on the learner and may even become counter-productive to learning. At that point, providing new examples in which the learner must complete the problem using prior knowledge to acquire new knowledge may prove more useful.

The redundancy effect is when information in multiple forms or unnecessary information needed for the current task is presented to the learner (Bobis et al., 1994; Chandler & Sweller, 1991; Mayer et al., 1996; Sweller, 2016; Torcasio & Sweller, 2010). This excess information could include providing PowerPoint presentations, textbook examples, songs, and other forms of presentation on the same information. According to theorists, this overloads the working memory and the extraneous cognitive load, thus inhibiting learning.

The split attention strategy involves providing the learner with two or more sources of information, but in a manner in which all of the sources are needed for understanding and in which each singular source is insufficient for learning the material (Cerpa et al., 1996; Owens & Sweller, 2008; Sweller et al., 1998; Tarmizi & Sweller, 1988; Ward & Sweller, 1990). However, researchers have shown this to have very negative consequences on learning. Both the split attention and redundancy strategies directly contradict the strategies employed in the current study.

The modality strategy, however, supports the methodology of this study. This strategy involves presenting the information through multiple forms of communication such as both auditory and visual (Baddeley, 1983, 2002; Baddeley & Hitch, 1974; Jeung et al., 1997; Mousavi et al., 1995; Penney, 1989; Tindall-Ford et al., 1997). The modality strategy has been shown to reduce the extraneous cognitive load and promote the germane load. While several of these strategies either support or contradict the current study, it should be noted that the foundational studies on these strategies were completed using primary or elementary school students and not college students.

Much of the initial research on cognitive load and working memory came from problem-solving strategies utilized in the game of chess (Paas et al., 2003; Sweller, 1988). In his work with master and novice chess players, De Groot (1966) examined the differences between chess players' thought processes. Through his questions and tests, De Groot failed to find any significant differences between master and novice chess players with regard to the number of moves considered at one time, moves search heuristics, and depth of search for possible moves.

He found that in their thinking, master and novice players think through roughly the same number of moves before deciding on which move to make. While master players took less time to decide on the correct move, all players considered roughly the same number of moves.

De Groot (1966) did find a significant difference between master and novice chess players with regard to remembering and recreating chess board configurations. Master chess players were able to recreate realistic chess board configurations after viewing them for as little as five seconds, while novice players were generally not able to recreate the same configurations. However, when presented with random chess board configurations, there was no significant difference between master chess players and novice chess players in their ability to recreate the boards. Chase and Simon (1973a, 1973b) also found the same results in their studies with chess players. These findings suggest that it is not merely the short-term memory process that was aiding the master players in recreating configurations, but something such as long-term and repeated exposure to realistic configurations and more long-term memory processes.

Information Recall

Previous research indicates that subjects' abilities to recall information may decline over time (Tillmann & Dowling, 2007; Waugh & Norman, 1965) or when added information is presented between the initial presentation of information and the need to recall that information (Waugh & Norman, 1965). In contrast, the same decline in recall does not appear when music is being recalled (Dowling et al., 1995; Tillmann & Dowling, 2007). These studies indicate that music may aid in the recall of surface-level details and may help overcome the interference or time-delay hindrances. However, these studies involved the examination of a subject's ability to recall and recognize music patterns and phrases rather than recall text or text-based concepts.

Prose and Text Recall

Waugh and Norman (1965) examined four Harvard undergraduate students on their abilities to recall information. It should be noted that the small sample size is considered in this review, and this study is included due to its prevalence in the citations of the other studies cited here. The experiment included having subjects listen to a list of 16 random numbers with no digit appearing more than twice in a row, and the last digit was a digit already presented in the list. The lists were recorded and thus played with speeds of one word per second or four words per second. Subjects listened to eight test sessions and then 12 experiment sessions in which the lists alternated speeds of presented numbers. Following the final number, a tone was played cuing the subject to recall the next number the first time it was heard in the list (i.e., in the list 1-2-3-4-5-3, the correct answer would be third). Results indicated that subjects' abilities to recall the correct number decreased the farther away the number was from the final number, with subjects' abilities of correctly recalling the number being "effectively zero for the eleventh item in from the end of a list" (Waugh & Norman, 1965, p. 92). While these results would lend support to the idea that short-term recall ability decreases over time, even time as short as 10 to 50 seconds, the power of these results should be questioned due to the small number of subjects.

In a four-part experiment, Tillmann and Dowling (2007) first examined 24 undergraduate psychology students' ability to detect differences between lines of poetry presented with a short or long time delay between hearings. Participants would listen to a poem, experience a long (19.2 seconds) or short (9.6 seconds) delay, and then hear either an exact repetition of the first two lines (O), a paraphrased repetition of lines three and four where the words were changed, but the meaning remained the same (P), or a rewording of lines three and four (M). Results of the first experiment indicated a significant main effect of item comparison, and this interacted with testing delay with performance being better for O/M comparisons over O/P comparisons. Further results indicated a significant main effect of target position with higher scores for lines one and two than lines three and four. Results also indicated that participants were able to discriminate between exact repetitions and paraphrases with no significance linked to the positions of the lines and the time delay between hearings. These results for the first experiment of the study indicate that the ability to retain fine details of poetry does not decline over short periods.

In the second experiment of the study, Tillmann and Dowling (2007) asked 46 undergraduate psychology students to compare hearings of text again and determine if they were the same or different. This experiment used a short story, rather than poetry, but utilized the same methodology of the previous O/P/M comparisons. Results indicated a significant main effect of item comparison and test delay with performance being better for O/M comparisons over O/P comparisons with a shorter time delay. The interaction between test item and testing delay was significant, indicating a large decrease in correct responses over a longer time delay. This result may indicate that the meter and rhythmic qualities of the poetry, similar to those of music, may aid in discrimination tasks and memory recall.

In the third experiment of the Tillmann and Dowling (2007) study, 95 undergraduate psychology students were divided into two groups: prose and poetry. The researchers used the same conditions from the previous two experiments, with the exception that they utilized more lines of both the prose and the poetry groups in the questioning. Results indicated a significant three-way item comparison by testing delay by material interaction for Experiment 3. Results also indicated a decline in discrimination for prose group but not for the poetry group.

In their final experiment of the study, Tillman and Dowling (2007) asked 43 undergraduate psychology students to once again discriminate between O/P/M comparisons of prose and poetry with the addition of a visual component: the words were shown line-by-line on a computer screen as they were read. Results for this experiment indicated a significant decline in correct responses in the prose group after a long time delay, but the poetry group success rate difference after the long time delay was not significant. This result may indicate that the rhythmic property of poetry can aid with memory recall, especially when paired with a visual stimulus.

Music Recall

Dowling et al. (1995) examined undergraduates' abilities to discriminate differences in contour and pitches between instrumental examples through a seven-part study. In the first experiment, subjects (N = 57) were presented with tonal and atonal examples of seven-note melodies. The trial consisted of the tonal and atonal examples being presented in separate trials. A total of 60 melodies were tested with two nonrelated and untested melodies intermixed during the trials. Subjects were presented with each melody in succession with subjects being cued to discriminate the given melody with a previous melody as to whether it had the same contour (SC) as the original, was an exact transposition (T) of the original, or had a different contour (DC) than the original. Subjects were asked to make comparisons between a cue and a melody that was presented anytime from immediately preceding the cue to eight melodies prior.

Results indicated that tonal examples were easier to discriminate between T, SC, and DC than atonal examples, $F(1, 55) = 15.03$, $p < .001$ (Dowling et al., 1995). "The effect of delay was significant [$F(4, 220) = 3.20$, $p < .02$], with best overall performance at delays of 7 and 47 sec (.64 and .63 [area scores], respectively) and poorest performance at delays of 17, 27, and 87 sec (.60, .61, and .59 [area scores], respectively)" (Dowling et al., 1995, p. 140). T/SC discriminations (0.63) were also significantly easier than T/DC (0.60) discriminations, $F(1, 55) = 23.27$, $p < .001$. Results also indicated the discrimination abilities declined more over time for T/DC than T/SC, $F(4, 220) = 10.12$, $p < .001$. Results from the first experiment indicated that those subjects with less music experience had results that "on T/SC comparisons peaked more sharply and on T/DC comparisons fell off more rapidly than for the experienced subjects" (Dowling et al., 1995, p. 141), $F(4, 220) = 2.85$, $p < .05$. Main effects of delay [$F(4, 220) = 8.33$, $p < .001$] and comparison type [$F(4, 220) = 146.01$, $p < .001$] as well as interactions of tonality by comparison type [$F(2, 110) = 11.27$, $p < .001$], delay by comparison type [$F(8, 440) = 2.08$, $p < .05$], and tonality by delay by comparison type [$F(8, 440) = 2.40$, $p < .02$] were significant. In sum, these results indicate that subjects tend to be able to discriminate T/SC examples, even over a delay of time, which could indicate that a familiarity of tunes could facilitate ease of discrimination over attempting to compare DC melodies.

In the second of seven experiments, Dowling et al. (1995) replicated the first experiment with only one difference: subjects ($N = 27$) were now asked to indicate T, SC, or DC with melodies being paired together in succession rather than having any delay or other melodies between. Results from the second experiment contrasted with the first in finding that T/DC comparisons were easier than T/SC comparisons, $F(1,25) = 64.85$, $p < .001$. In comparison from the first experiment, the difference flipped from atonal to tonal comparisons, and the T/SC versus T/DC results. The lack of time delay between compared pairs could have been the reason for these results.

The third of seven experiments by Dowling et al. (1995) replicated the first experiment; however, this trial included only three possible time delays for subjects ($N = 36$) to manage: 17, 47, or 87 seconds. Results from this trial again found T/SC comparisons (0.61) easier than T/DC comparisons (0.57), $F(1,34) = 21.12$, $p < .001$. The only other significant result from the third experiment indicated that tonal T/SC discriminations were easier than any others, $F(1,34) = 6.23$, $p < .02$.

In the fourth of seven experiments, subjects ($N = 56$) were now only presented with 90 pairs of melodies and only three delay possibilities of 7, 12, or 33 seconds (Dowling et al., 1995). As with Experiment 3, melody pairs were compared one right after the other. Results indicated significant effects of delay [$F(2,108) = 10.58$, $p < .001$], with short delays resulting in better performance than longer delays. A main effect of comparison type was also found [$F(1,54) = 32.00$, $p < .001$] with T/DC comparisons (0.66) being significantly easier than T/SC comparisons (0.59).

For Experiment 5, Dowling et al. (1995) utilized 24 familiar folk melodies and 24 unfamiliar folk melodies rather than pairs of artificially constructed melodies for comparison. Subjects ($N = 18$) were only presented with a 6-second delay between pairs and were asked to again discriminate between T, SC, and DC. Results indicated a significant effect of familiarity [$F(1,16) = 83.75$, $p < .001$] with familiar items (0.94) being easier than unfamiliar items (0.67) on discrimination tasks. The comparison effect [$F(1,16) = 86.15$, $p < .001$] was also found to be significant, with T/DC comparisons (0.91) being easier than T/SC comparisons (0.70).

Experiment 6 utilized the melodies from Experiment 5 with the presentation methodology of Experiment 3 (Dowling et al., 1995). Subjects ($N = 31$) were again asked to make T, SC, and DC comparisons. In this experiment, results indicated a significant effect of musical experience [$F(1, 29) = 9.03$, $p < .01$], with experienced subjects performing better (0.77) than inexperienced subjects (0.66). Once again, familiar tunes were easier to differentiate (0.80) than unfamiliar tunes (0.61), $F(1, 29) = 101.80$, $p < .001$. Interestingly, success increased in familiar tunes with longer delays (0.78 to 0.83) but decreased for unfamiliar tunes with longer delays (0.63 to 0.59), $F(1, 29) = 6.93$, $p < .02$. Also, T/DC comparisons (0.75) were found to be easier than T/SC comparisons (0.68), $F(1, 29) = 12.81$, $p < .001$. However, T/SC success increased with longer delays, while T/DC success decreased with longer delays, $F(1,29) = 16.19$, $p < .001$. Interestingly, experienced subjects tended to improve in their comparisons over time while inexperienced subjects tended to decline in their comparisons, $F(1,29) = 4.90$, $p < .05$.

The final experiment was identical to Experiment 6 except that subjects ($N = 17$) were given comparison melodies in the same key and pitch level as the original (Dowling et al., 1995). Results again indicated experienced subjects (0.80) significantly outscored unexperienced subjects (0.66), $F(1, 15) = 16.13$, $p < .01$. Once again, familiar melodies (0.80) were easier to discriminate than unfamiliar melodies (0.64), $F(1, 15) = 28.35$, $p < .001$. Also, as with Experiment 6, T/SC success increased with longer delays while T/DC success decreased with longer delays, $F(1, 15) = 4.56$, $p < .05$.

In a five-part study, Dowling et al. (2001) examined college students' memories and experiences of hearing music. In the first experiment, subjects ($N = 22$) were presented with 15 to 25 seconds of a piece by Mozart, Haydn, Beethoven, or Schubert played on a piano. For each piece, a target phrase was selected as either the first two or the second two measures of the piece. After hearing the initial performance of the excerpt, a delay would be observed of either 5 or 15 seconds, followed by a repetition of the excerpt with the target phrase either played exactly as before (T), imitated in a way that changed one or more features (i.e. different pitch level, texture, chords, or rhythm) with the contour remaining the same (S), or something completely different from the original (D). Subjects were presented with 48 trials and asked to respond on a 6-point Likert-type scale: (6) "very sure same," (5) "sure same," (4) "same," (3) "different," (2) "sure different,” or (1) “very sure different” (Dowling et al., 2001, p. 258). Subjects were only to answer "same" if the test item was the same as the original.

Results from the first experiment indicated significant delay by item interaction with T/S comparisons increasing with time and T/D comparisons decreasing with time, $F(1,20) = 10.05$, $p < .01$, $R^2 = 0.026$ (Dowling et al., 2001). The position of the target phrase was also significant as discrimination with regards to the first phrase (0.84) was better than for the second phrase (0.66), $F(1,20) = 45.76$, $p < .01$, $R^2 = 0.172$. Time delay was also significant with subjects interestingly performing better with a 15-second delay (0.80) than at a 5-second delay (0.70), $F(1,20) = 6.63$, $p < .02$, $R^2 = 0.051$. Subjects were also better able to determine T/D discriminations (0.79) than T/S discriminations (0.70), $F(1,20) = 18.47$, $p < .01$, $R^2 = 0.047$. These results indicate that performance for T/S discriminations improved over time, possibly indicating that as subjects become more familiar with T/S items tasks, they learn to discriminate better. For the current study, this could indicate that as familiarity with something rises, so does the subject's ability to remember previous presentations may also increase.

In their second experiment of the study, Dowling et al. (2001) exposed subjects ($N = 52$) to the same type of trials as in experiment one with the following exceptions: (1) there were now 72 trials and (2) test delays were at 4, 15, and 30 seconds. Once again, success increased over time for T/S discriminations and remained unchanged for T/D discriminations, $F(2,96) = 6.24$, $p < .01$, $R^2 = 0.008$. However, overall success was better for T/D discriminations (0.78) than for T/S discriminations (0.70), $F(1,48) = 56.71$, $p < .01$, $R^2 = 0.041$. Once again, discrimination for first phrase targets was better (0.78 vs. 0.69) than for second phrase targets, $F(1,48) = 24.44$, $p < .01$, $R^2 = 0.053$. In sum, results from the second experiment mirror those of the first.

In their third experiment of the study, Dowling et al. (2001) replicated Experiment 1 with the exception that the subjects (*N* = 28) were only presented with the target phrases to discriminate against with a delay of 5 or 15 seconds between hearings. The results from this experiment contradicted the previous two from the study in that TD discriminations were more successful (0.96 vs. 0.87) than T/S discriminations, $F(1,26) = 47.53$, $p < .01$, $R^2 = 0.151$. Dowling et al. attributed these results to the structure of the melodies providing some recognition to the subjects for the task.

The fourth experiment of the study had subjects (*N* = 30) replicate the trials from Experiment 3 with an added rhythmic sound clip added to the time delay between targeted discriminations (Dowling et al., 2001). Results from this experiment included, for the first time in this study, a significant effect of experience, with experienced subjects performing better (0.92 vs. 0.85) than inexperienced subjects, $F(1,28) = 4.78$, $p < .05$, $R^2 = 0.054$. As with the previous experiment, T/D discriminations (0.94) were more successful than T/S discriminations (0.84), $F(1,28) = 56.82$, $p < .01$, $R^2 = 0.102$. In comparing these two results, there was also a significant interaction with experience X item type, with inexperienced subjects performing significantly worse on T/S than T/D discriminations (0.79 vs. 0.92), while experienced subjects did not experience as much of a decrease in success (0.89 vs. 0.96), $F(1,28) = 8.10$, $p < .01$, $R^2 = 0.015$.

In the final experiment of the study, Dowling et al. (2001) informed subjects (*N* = 60) that they would be rating musical examples on "liking or pleasantness" (p. 269). However, after the example played, a researcher stepped in and asked the participant if the last musical phrase heard was the same as a phrase heard earlier in the piece with the subjects using the same 6-point Likert-type scale as the previous experiments. Subjects in this experiment were only given one trial and were only presented with examples that included T or S phrases. The final experiment found no significant difference between T and S.

In sum, the Dowling et al. (1995) experiments seem to contradict the earlier findings of Tillman and Dowling (2007) and Waugh and Norman (1965), which indicate that memory declines over time. With these experiments, especially with familiar melodies and T/SC tasks (Dowling et al., 2001), time delays seemed to benefit subjects. This result could indicate that including familiar music with memory tasks could facilitate a subject's ability to recall information at longer time intervals. While these studies do not directly pertain to the current study, they are important to present here as they provide evidence of music's ability to aid in memory recall.

Music Memory in Marketing and Advertising

Music and repetition may not be used in advertising campaigns in radio and television simply because they are an extra option, but may be used in order to aid in the transfer of information from short-term to long-term memory and to aid consumers in the implicit recall of information. Marketers and advertising agencies have discovered that unconscious reactions to their advertisements more accurately indicate consumer behaviors than surveys and reports that consumers consciously provide (Alexomanolaki et al., 2010; Pham & Vanhuele, 1997; Shapiro & Shanker, 2001; Yalch, 1991). If the combination of music and repetition affects consumer thinking and memory recall, it must have an application in the classroom.

Alexomanolaki et al. (2010) examined 67 undergraduate students in an attempt to discover how music affects the associations of commercials with memory. The participants were shown five separate television commercials twice with audio removed and replaced with one of two conditions: (1) music from an unfamiliar source or (2) music from a familiar commercial in which another product was advertised. Participants were then asked to identify the two songs and indicate their familiarity with the jingles, to identify which product each jingle was most likely to be advertising, to indicate their familiarity with the visual elements of the commercials with all audio removed, and finally to indicate what part of the music best fit which product and why. Participants were then divided into two groups: Group 1 viewed the commercials accompanied with the unfamiliar jingle first, and Group 2 viewed the commercials accompanied with the familiar jingle first.

Results indicated that the majority of both groups (74.5% and 65%) were still unfamiliar with the unfamiliar music even after exposure to the commercials and that the order of the videos did not affect the responses (χ^2 [1] = 2.059; $p > 0.05$; Alexomanolaki et al., 2010). Results also indicated that the unfamiliar jingle, which was initially a jingle for a jeans commercial, would not be best for the advertising of jeans. When asked about their familiarity with the commercials after the audio was stripped away, most of the participants indicated they were familiar with the commercials. Finally, when asked which commercial of the five they had viewed the unfamiliar music best fit, most participants chose either the first commercial or the last commercial viewed, even if they could not recall what the commercial was advertising. These results indicate that using a familiar piece of music may aid in helping recall commercials or possibly other pieces of information, thus aiding at least short-term memory.

In a two-part experiment, Yalch (1991) investigated if subjects more successfully remembered advertising slogans presented as jingles than those not presented as jingles. Participants (N = 103) were divided into two groups in which they were asked to pair brands with slogans. One group (aided recall) was given a list of 20 slogans and was asked to give the brand of the product used for the slogan, while a second group (recognition) was provided with a list of brands and slogans and were asked to match the brand to the appropriate slogan. For each group, 10 slogans used jingles in their original presentations, while the other 10 did not. Results indicated a significantly higher number of correct responses in the aided recall group when the slogan initially used a jingle in the advertising campaign (*Ms* = 6.12 and 5.19), $t(50) = 3.2$, $p < .005$. However, this result was reversed in the recognition group, *Ms* = 7.35 and 7.76; $t < 1$. This result seems to indicate that when asked to recall information with no matching answers, music in the mnemonic device could be helpful. However, if provided with a matching task, the musical aid may not be beneficial.

In the second experiment of the study, Yalch (1991) asked undergraduates ($N = 124$) to complete the same type of assessment as in the previous experiment: aided recall and recognition. However, in this experiment, Yalch presented the participants with audiotapes of 12 slogans, of which six had jingles and six were spoken. The slogans were randomized, with half of the jingles played twice, and half of the non-jingles played twice. This mix of exposures was switched for half of the participants, ensuring that all of the slogans were played twice. The results of the second experiment had significant main effects for type of memory task, $F(1, 122) = 22.9$, $p < .001$; use of a jingle, $F(1, 122) = 46.4$, $p < .001$; and number of exposures, $F(1, 122) = 25.6$, $p < .001$. These results indicated better results in the recognition group for slogans with jingles and for slogans heard twice. The use of a jingle yielded significantly higher scores in the aided recall group (*Ms* = 2.77 for no jingle and 3.57 for jingle), $t(59) = 6.4$, $p < .001$, and in the recognition group (*Ms* = 3.60 for no jingle and 3.80 for jingle), $t(63) = 2.5$, $p < .05$, with the aided recall group performing better than the recognition group. The use of a jingle also significantly increased the correct response rate for both one exposure (*M*s = 1.44 for no jingle and 1.78 for jingle), $t(123) = 5.6$, $p < .001$, and two exposures (*Ms* = 1.75 for no jingle and 1.90

for jingle), $t(123) = 3.1$, $p < .05$. These results also indicate that the use of a jingle is useful in helping memory recall for information.

Researchers have examined subjects' abilities to recall text when the text is paired with music, such as lyrics or simply music heard while memorizing a text. This research has primarily dealt with the following conditions: music as background sound, subjects with mental disabilities, or mnemonic-like songs.

Research with Music as Background Sound

Smith (1985) examined the ability of students to recall a list of words after the wordlist was paired with jazz, classical, or no music. Students were then tested with the same or different music playing in the background. In the first of two experiments, subjects ($N = 54$) were shown a list of forty words with each word printed on a single index card. The researcher presented index cards to each subject one at a time with the index cards changing at the rate of one card per every 5 seconds. Subjects were then given 5 minutes to recall the 40 words after the presentation of the last word. Subjects were then brought back 48 hours later and given an additional 5 minutes to recall the list of words. Subjects were also divided into three treatment groups in which the designated music played in the background for the first treatment: jazz (J), Mozart (M), or silence (Q). For the second recall task, each group (J, M, and Q) was divided randomly into thirds and presented with one of the three background sound conditions, thus creating the following possible conditions: JJ, JM, JQ, MM, MJ, MQ, QQ, QJ, or QM.

Results from Experiment 1 indicated no significant difference in treatment groups (J, M, and Q) from the first recall (Smith, 1985). However, in the second recall test, subjects with the same music condition in both settings (JJ or MM) forgot significantly fewer words (2.17) than subjects in different (4.28) conditions, $F(1, 48) = 6.64$, $p < .05$, $MS_e = 8.06$. Results through a 2

X 2 ANOVA indicated significantly better results for those subjects who were in the M treatment for both tasks than any other treatment, $F(1, 32) = 5.33$, $p < .05$. Results indicated no significant difference in scores for subjects between any of the Q treatments when paired with an M or J treatment or between those in music treatments when paired with a different treatment for the second recall task.

In the second of two experiments, Smith (1985) replicated the first experiment, this time with 90 subjects, with the following exceptions: white-noise (N) replaced the M treatment, and half the subjects in each treatment were presented the list of words visually and half were presented the list audibly. No significant differences were found between the two groups in the initial recall task.

As with the first experiment, subjects in the same treatment condition for both recall tasks had significantly better success at accurately recalling the list of 40 words, $F(1, 78) = 7.05$, $p < .01$, $MS_e = 3.97$ (Smith, 1985). A significant interaction was found between treatment conditions indicating that when sound was played for the first treatment (J or N), subjects with the same sound in the second treatment had better success than with those experiencing a different sound in the second treatment, $F(1, 52) = 18.95$, $p < .001$, $MS_e = 3.48$. There was no significant effect on Q treatments. The only significant interaction found with regards to the visual versus aural presentation of the lists was that subjects who were in different treatment groups from the first treatment to the last scored significantly better when the list was presented visually rather than aurally, $F(1, 52) = 4.42$, $p < .05$.

The results of this study indicate that music, be it jazz or classical, may play a role in helping subjects to remember lists of words. While the result of visual presentation outscoring aural presentation raises questions for the present study, the fact that this only occurred when the subjects were in different treatments offers a clue that something else may be at work with this result. Also, the use of white noise rather than music linked to the text may have been a factor in the visual presentation outscoring the aural presentation.

Balch et al. (1992) had similar results when pairing words with pleasant and unpleasant music cues. In experiment one of three, the researchers presented subjects (N = 240) with a list of 24 words each typed on a single index card. Words were presented one at a time at a rate of one word every five seconds. While presented with words, subjects were also played one of four musical selections: fast jazz (FJ), slow jazz (SJ), fast classical (FC), or slow classical (SC). During the presentation of the words, subjects were asked to rate each word immediately after its presentation on its pleasantness: (1) very unpleasant, (2) moderately unpleasant, (3) slightly unpleasant, (4) slightly pleasant, (5) moderately pleasant, (6) very pleasant. Following the presentation of all 24 words, subjects were asked to either write down as many of the words as they could remember or to come back in two days for another task, when upon their return they were then asked to recall as many of the words as they could. For both recall tasks, subjects were presented with either the same musical cue, a different musical cue, or no musical cue.

Results from this experiment indicated a large and significant effect of retention interval, $F(2,216) = 482.32$, $MS_e = 6.78$, $p < .05$ (Balch et al., 1992). Subjects averaged 13.03 words in the immediate recall task and only 5.64 in the delayed recall task. The only other significant effect was the effect of musical cue and retention level, $F(2,216) = 4.65$, $MS_e = 6.78$, $p < .05$.

For the immediate recall group, subjects hearing the same cue averaged 13.85 correctly recalled words, no cue averaged 13.08, and a different cue averaged 12.15, with the main effect of cue being significant, $F(2, 108) = 3.59$, $MS_e = 8.06$, $p < .05$ (Balch et al., 1992). While this result indicates that subjects hearing the same musical cue tend to have better recall, it is interesting to note that the effect of presentation type was not significant.

For the delayed recall group, subjects averaged between 5.15 and 5.95 correctly recalled words, with the same musical cue being the lowest and no musical cue being the highest (Balch et al., 1992). Unlike the immediate recall subjects, no significant effects or interactions were found. This result may indicate that a musical background does not facilitate memory recall when a substantial time delay is present between the initial learning and the recall task.

In the second experiment, Balch et al. (1992) replicated the first experiment with new subjects ($N = 120$) with the following exception: groups for recall were only presented with different tempo (slow vs. fast) or different form (jazz vs. classical), and there was not a music free cue condition. The only significant effect found was a main effect for cue [$F(2,108) = 7.06$, $MS_e = 6.14$, $p < .05$], with scores for the same cue groups being the highest (14.1 words) and the different tempo group scoring the lowest (12.03 words) and the different form group falling in the middle (13.2 words).

In the third and final experiment, Balch et al. (1992) replicated the second experiment with 80 subjects, with the following difference: a "distraction piece" was played after the initial learning of the words and before the recall task. The distraction piece was a piece of Asian music chosen because it was completely different from the condition pieces. Once again, a significant effect was found on recall interval [$F(1, 72) = 205.01$, $MS_e = 5.13$, $p < .05$], with subjects in the immediate recall groups scoring higher ($M = 12.27$) than the delayed recall group ($M = 5.5$). Results also indicated a significant interaction between musical cue and retention interval [$F(1,72) = 6.05$, $MS_e = 5.13$, $p < .05$], with subjects receiving the same musical cue scoring higher than the subjects hearing different musical cues for the recall tasks. For the immediate recall groups, the effect of the cue was significant [$F(1,36) = 4.83$, $MS_e = 6.71$, $p < .05$], with the same cue group recalling more words (13.65) than the difference cue group (11.85). The same effect of the cue was not found for the delayed-recall group, nor was any other effect found to be significant with this group.

In sum, this study lends support to the idea that music can aid subjects with the recall of information. While this study (Balch et al., 1992) did not incorporate the list of words into music other than playing music in the background, it does suggest that music can aid in the recall of words, as does the previous study (Smith, 1985). Balch et al. also indicated that the tempo and length of musical cues do not necessarily affect subjects' ability to recall information.

Research with Subjects with Mental Disabilities

In an article examining 54 right-handed subjects with relapsing remitting multiple sclerosis, Thaut et al. (2014) looked at subjects' abilities to recall a list of 15 semantically unrelated words. Researchers randomly divided subjects into two groups: sung and spoken. Both groups heard the same list of 15 words spoken or sung to an original song in simple AABA form, at a rate of one syllable per second. After each hearing, subjects were instructed to attempt to recall as many of the words as possible. After the 10th presentation of the word list and recall attempt, subjects were presented with a recording of a new list of words either spoken or sung depending on the group. They were then asked to recall the original list of 15 words. Subjects were then given a visual task to complete for 20 minutes before being asked to recall the original list of 15 words for a final time.

Results indicated significantly higher success rates with the sung group for the overall recall of words throughout the trial ([two-way ANOVA: F (1.52) = 4.12; $p = 0.45$; mean squared error = 0.057], Thaut et al., 2014). A two-way ANOVA also indicated a significantly higher success rate in subjects recalling the list of words in the original order in the sung group over the spoken group, $F(1,2) = 4.51$, $p = 0.038$. "Regression analysis between correct word order recall as a predictor of magnitude of overall word recall was highly significant in the sung condition . . . ($p = 0.15$, $R^2 = 0.29$; beta = -0.54; Corr. = -0.54)" (Thaut et al., 2014, p. 4). While this study examined subjects with multiple sclerosis, the results still point to the fact that mnemonic-like songs can aid in information recall.

In a study involving subjects diagnosed with multiple sclerosis ($N = 54$), Moore et al. (2008) examined the effectiveness of a mnemonic-like song on subjects' abilities to recall a 15-word list. Four neuropsychological tests were administered to all subjects: Buschke's Selective Reminding Task (SRT), which measured verbal learning and memory; Logical Memory I, a subset of the Weschler Memory Scale–3rd ed. (WMS-III), another test that measured verbal learning and memory; the Wisconsin Card Sorting Test (WCST), which measured executive functioning; and the Seashore Rhythm Test, which measured sustained attention. Subjects were also administered a version of the Rey's Auditory-Verbal Learning Test (AVLT; Lezak, 1995), a test designed specifically for use with patients with multiple sclerosis. The AVLT presents subjects with a 15-word list aurally for 10 trials with the subjects being asked to immediately attempt to recall the list after each trial and to attempt again to recall the list 20 minutes later, following the 10th trial. At the end of the initial 10 trials, subjects were given a distractor list of 15 new words and asked to recall them before being asked to again recall the original list. During the 20 minutes following the final trial, participants were given a visual task to complete as yet another distracting task. Subjects were then presented a list of 50 words, which included words from both the original list and the distractor list as well as new words. Subjects were then asked to indicate, following the presentation of each word, if that word was from the original list, the distractor list, or neither list. In a final test, researchers again presented subjects with the new 50-word list, this time without pause, and then asked them to repeat the list back in order. For all of these trials, subjects were divided into two groups: a group where the lists were sung to the tune “Skip to My Lou” and a group where the word lists were spoken to the subjects.

Results indicated no significant differences between the two groups in any of the tasks with regard to recalling the word list or recognizing from which list a word derived (Moore et al., 2008). However, there were significant correlations within the music group regarding individuals’ levels of cognitive degeneration. These included percentage of words recalled ($t(20) = 0.73$, $p < 0.01$), percentage of correct responses from long-term storage ($t(20) = 0.76$, $p < 0.01$), and remembered unites from the recall of the complete 50-word list ($t(20) = 0.58$, $p < 0.01$). These results indicated that the better the cognitive function of the patient, the better success they had in the tasks when they were presented with the mnemonic-like song.

Similarly, Peretz et al. (2004) found that the recall of lyrics, even those lyrics on neutral syllables such as "la," was achieved at greater success when pairing the test with the tune employing the lyrics than with the lyric-less tune. In the first of their three-experiment research, Peretz et al. examined the abilities of college students ($N = 64$) to identify whether or not the lyrics or melody from a tune were familiar or not. The subjects were presented with two parts of folk songs that were either sung on a neutral “la” syllable or were spoken without melodic inflection. The folk songs were mixed between melody and melody, melody and spoken, spoken and spoken, and spoken and melody, resulting in 48 trials. The melodies were randomly mixed, with 24 of the trials using the same song for both halves of the trial and 24 of the trials using different songs for the two halves of the trial. Subjects were then given six seconds following the trials to indicate if they recognized the second half of the trial as being a familiar folk tune or not.

Results from the first experiment indicated two main effects: target type and relatedness (Peretz et al., 2004). The target type effect, $F(1,60) = 92.81$, $MS_e = 0.65$, $p < .001$, indicated that lyrics were easier to recognize than melodies. The relatedness effect, $F(1,60) = 219.36$, $MS_e = 0.22$, $p < .001$, indicated that it was easier for subjects to recognize folk songs when they were paired with material from the same song. These findings could indicate that subjects have greater abilities to recall lyrics than melodies, which could help in the pairing of mnemonic-like devices with songs in a longer song context.

In the second experiment, Peretz et al. (2004) replicated the first experiment with the subjects ($N = 96$) now being asked to indicate if they recognized the trials with the halves of the trials reversed from the first experiment. In this experiment, if the song was played with both halves coming from the same song, they would be heard in reverse order from how they naturally occurred in the original folk melody. Results again indicated the same two main effects: target type and relatedness. Target type results [$F(1,92) = 12.25$, $MS_e = 0.0068$, $p < .001$] indicate that spoken lyrics were easier to recognize than melodies. The effect of relatedness [$F(1,92) = 9.41$, $MS_e = 0.0074$, $p < .003$] indicated that, as with the first experiment, songs were more easily recognizable when both halves came from the same song.

In the third experiment, Peretz et al. (2004) replicated the trials from the first experiment but this time doubled the number of trials by having each part of each melody heard both with its corresponding half, and, in a separate trial, heard with a different half (N = 96). Results indicated a main effect for repetition [$F_1(1,92) = 60.72$, $MS_e = 10{,}722$, $p < .001$, and $F_2(1,23) = 46.97$, $MS_e = 14{,}527$, $p < .001$], meaning that subjects were better able to recognize melodies with repetition. Once again, songs were more readily recognized when presented as a whole than in different halves no matter if spoken or sung, $F_1(1,30) = 20.59$, $MS_e = 2,627$, $p < .001$, and $F_2(1,23) = 15.01$, $MS_e = 5,064$, $p < .001$.

In the fourth and final experiment, the researchers added white noise to any of the spoken parts of the trials that subjects (N = 96) heard (Peretz et al., 2004). Other than that difference, the researchers replicated Experiment 2. The only significant effect in this experiment was the relatedness effect indicating once again that subjects were better able to recognize melodies in related pairs than unrelated pairs, $F(1,92) = 20.95$, $MS_e = 0.0032$, $p < .001$. In sum, the results indicated that information is better recognized when paired with relevant information than with unrelated information. This result could lend further support to the notion that mnemonic-like songs, even longer songs, could help subjects with information recall as long as the information is related.

Research with Mnemonic-Like Songs

Calvert and Tart (1993) attempted to assess short-term, long-term, and even very-long-term memory of information presented in a song. In part one of their two-part study, Calvert and Tart asked 16 participants to self-report their exposure to the musical vignette on the television show "School House Rock" about the preamble to the constitution of the United States of America. Participants were then asked to recall the words to the best of their abilities. Calvert and Tart reported that the more exposure a participant had to the vignette, the more likely they were to use singing as their method for recalling the words, χ^2 (1, $N = 16$) = 9.60, $p < .005$. Participants who used singing as a recall strategy recalled significantly more ($M = 37.88$) words than those who did not ($M = 8.63$), $t_{(14)} = 4.50$, $p < .001$.

In part two of their study, Calvert and Tart (1993) divided 28 college students into four groups: singing with repetition, verbal with repetition, singing without repetition, and verbal without repetition. The same musical vignette from the first part of the study was again used either in song or spoken form. Those in the repetition groups were exposed to the information twice a week for four weeks totaling eight exposures. Participants were once again asked to write down as much of the preamble to the constitution of the United States of America as they could remember. Results indicated a main effect of repetition, $F(1, 24) = 89.44$, $p < .0001$; a main effect of presentation form, $F(1, 24) = 8.84$, $p < .01$; and a repetition by presentation interaction, $F(1, 24) = 4.58$, $p < .05$; with the singing treatments and the singing with repetition treatments yielding the best results.

In order to assess the long-term memory of the participants, Calvert and Tart (1993) asked the participants to return five weeks after the initial assessment to once again recall as many words of the preamble as they could. The results of the two-factor ANOVA yielded a main effect of repetition, $F(1, 24) = 65.63$, $p < .0001$; a main effect of presentation form, $F(1, 24) = 6.18$, $p < .02$; and a repetition by presentation form interaction, $F(1, 24) = 6.94$, $p < .01$. Single exposure treatments through either song ($M = 9.14$) or verbal only ($M = 9.57$) showed no significant differences over long-term memory. However, with repetition, singing ($M = 40.29$, $p < .05$) scores were significantly higher than verbal ($M = 25.43$, $p < .05$) scores. These results indicate that information presented to participants through song can significantly help with long-term memory recall.

Rainey and Larsen (2002) examined college students' ($N = 79$) abilities to replicate lists of 12 unfamiliar baseball players from the 1948 Boston Braves and Cleveland Indians. The lists were recorded by singing the names to the tune of “Pop Goes the Weasel” with piano accompaniment and by speaking the names at a steady pace. Researchers divided participants into four groups: spoken Boston Braves' lineup, spoken Cleveland Indians' lineup, sung Boston

Braves' lineup, and sung Cleveland Indians' lineup. Participants would listen to their assigned recording, which was synched to a computer screen that would also present the names to the participants for clarification purposes. When the participants thought they were able to recite the complete list from memory, they would press a button and attempt their list. If they succeeded, the study was over; however, if they failed, they would resume listening and seeing their respective lists. Participants were brought back one week later and asked to recite their lists. If they were unsuccessful, they would repeat the same treatment as before until they could correctly recite their respective list. The entire experiment was once again repeated, with the participants now learning the opposite team from their first trial using the alternate method (spoken verses are sung or vice versa) from their first trial.

Results indicated no significant difference in the ability of subjects to recall lists of words for the initial recitation attempt between the sung (M = 27.75, SD = 16.32) and spoken (M = 28.72, SD = 14.94) versions, $t(77) = 0.28$, $p = .78$ (Rainey & Larsen, 2002). However, those participants hearing the sung lists required significantly fewer hearings (M = 4.65, SD = 3.75) than those hearing the spoken (M = 6.72, SD = 5.02) version of the lists, $t(77) = 2.07$, $p = .04$. t was reported that one of the participants was able to complete the recitation correctly after hearing the list sung to them only a single time. Interestingly, no significant difference was found in the number of trials needed between the sung (M = 24.00, SD = 14.45) and spoken (M = 24.49, SD = 16.90) versions on the second complete trial, $t(77) = 0.14$, $p = .89$. This study indicates that while the use of mnemonics through music may not significantly help the recall of information over a short period of time, it may aid the transfer of the information into long-term memory.

In a second study by Rainey and Larsen (2002), 102 college students were asked to recite a list of 14 nonsense names after listening to the list spoken or sung. Researchers used the same consonant and vowel structures and syllables of the names of the 13 dwarfs and a wizard from Tolkien's (1984) *The Hobbit*. For this experiment, the names were sung to the tune “Yankee Doodle” with no instrumental accompaniment. The researchers divided participants into three groups: sung list, spoken list, and visual-only with the list being presented on a computer screen with no auditory component. Each participant was then presented with the lists according to their respective groups until they were able to recite the lists correctly.

Results indicated a significant difference in the number of trials needed to initially learn the list, $F(2, 99) = 16.68$, $p < .001$, with participants in the visual-only group needing fewer trials to learn the list ($M = 16.15$, $SD = 10.01$) than those in the sung ($M = 32.29$, $SD = 14.06$) or the spoken ($M = 26.74$, $SD = 10.67$) group (Rainey & Larsen, 2002). There was no significant difference in the number of trials needed between the spoken and sung groups. However, after one week, there was a significant difference found, $F(2, 99) = 5.33$, $p = .006$, between the number of trials needed to correctly recite the list, with the sung group ($M = 2.97$, $SD = 2.82$) needing significantly fewer trials than the spoken group ($M = 5.85$, $SD = 4.34$). The visual-only group ($M = 4.12$, $SD = 3.67$) was not significantly different from either group on the second trial. This result once again adds support to the thought that mnemonic devices paired with music help participants with long-term memory recall.

Wallace (1994) conducted a four-part study examining the effect of melody on the recall of text. In the first experiment, 64 undergraduates heard three verses of two ballads. The researcher divided the participants into two conditions: sung ballad and spoken ballad. The participants listened to the ballad five times, wrote down what they could remember after trials one, two, and five, and then attempted to recall the ballad twenty minutes after the final trial. The researcher repeated the experiment with the second ballad. Results indicated a significantly greater recall abilities for the participants in the sung condition than in the spoken condition, $F(1,60) = 19.95$, $p < .0001$, $MS_e = 0.05$. Results also indicated that the participants improved significantly through the three initial writing attempts, $F(2, 120) = 598.96$, $p < .0001$, $MS_e = 0.009$, and a significant improvement with attempt two over one or five, $F(2, 120) = 3.27$, $p < .05$, $MS_e = 0.009$. Results also indicated no significant effect on the performance due to years of singing experience, years of playing a musical instrument, or ability to read music, $F(1,59) = 0.44, 0.35, 0.01$, respectively, $MS_e = 0.05$. Following the 20-minute delay, participants in the sung condition continued to significantly outperform the participants in the spoken condition, $F(1, 63) = 11.77$, $p < .001$, $MS_e = 0.02$. The results of the first part of the experiment continue to lend evidence to the notion that mnemonic devices utilizing music can significantly help memory recall.

Wallace's (1994) second experiment entailed having 21 undergraduates participate in the same treatments and experiment as before, but with a metronome added to both conditions in order to provide rhythmic stability and reference. Once again, results indicated a significantly better ability for the sung condition group to recall words than the spoken condition group, $F(1, 54) = 5.04$, $p < .03$, $MS_e = 0.06$. The same significant difference was found in the delayed recall trial, $F(1, 54) = 4.46$, $p < .04$, $MS_e = 0.04$. Also, as with the last experiment, no significant effect on the performance due to years of singing experience, years of playing a musical instrument, or ability to read music, $F(1,17) = 0.77, 0.09, 1.60$, respectively, $MS_e = 0.08$ was found. Once again, music was found to be a more significant help in recalling information that spoken word or rhythm.

Wallace's (1994) third experiment of the study examined the ability of 39 undergraduates to recall the text of one verse each of the two different ballads. The procedure for this experiment mirrored the first two. Results of this experiment were opposite that of the two previous experiments, with the spoken condition significantly outperforming the sung condition of recall, $F(1, 35) = 4.29$, $p < .05$, $MS_e = 0.10$. As with the previous two, musical training through singing, playing an instrument, or reading music yielded no significant effect, $F(1, 34) = 0.31$, 0.18, 0.01, respectively, $MS_e = 0.11$. The results of the delayed recall assessment again were opposite of the previous two experiments with the spoken condition significantly outperforming the sung condition, $F(1,38) = 4.75$, $p < .04$, $MS_e = 0.04$. This result may indicate that the repetition of melody through song may have some adverse effect on the aid of memory recall in both short- and long-term conditions.

The third and final experiment of Wallace's (1994) study involved examining the abilities of 48 graduate students now divided into five conditions: (1) spoken text, (2) text sung to original melody, (3) text sung to New Melody 1, (4) text sung to New Melody 2, and (5) verse one sung to the original melody, verse two sung to New Melody 1, and verse three sung to new Melody 2. The researcher followed the same procedure for this experiment as for the previous three, except for the removal of the delayed recall task. For the analysis of the results, the researcher combined the conditions involving the text sung to a single melody into one condition. Results indicated a significant effect of trial, $F(2, 90) = 556.70$, $p < .0001$, $MS_e = 0.007$, and a significant effect of condition, $F(2, 43) = 4.93$, $p < .02$, $MS_e = 0.04$, but no significant interaction of trial and condition. This result indicates that hearing the same melody, regardless of which melody, three times results in significantly better performance than the other two conditions. This result once again points to the idea that music can aid in short-term memory recall.

Theoretical Framework

The intuitive hypothesis driving this study is that the addition of melody to text will help facilitate the recall of concepts better than merely reading the text. The general framework guiding this expectation comes from the previous work involving studies using short melodies and random word lists or lyrical recall (Calvert & Tart, 1993; Wallace, 1994; Wallace & Rubin, 1988). Unlike the previous studies, this study aimed to examine if pairing concepts and their meanings with musical stimuli can aid recall. Unlike previous research, this is not simply a text recall exercise, but this study paired concept recall with information pairing. Participants were asked to not merely recall terms, but were also asked to pair the correct information concerning that term with the appropriate term, similar to that of the Yalch (1991) study. This study examined if the addition of the understanding of concepts to the verbatim recall of concepts can be aided through musical stimulus or if the cognitive load (Paas et al., 2003; Sweller, 1988) is overloaded due to this amount of information presented to each participant.

CHAPTER 3

METHODOLOGY

The research questions driving this study required an experimental design. The researcher divided students enrolled in Introduction to Business into treatment and control groups. The treatment group listened to a parody song that included a mnemonic device (Appendix A) covering the four principles of marketing (4Ps) and the six environmental forces (6Fs) concepts from the class's textbook, *Business Essentials* (Ebert & Griffin, 2017). This group was also instructed to read the chapter from the textbook that covered those concepts. The instructors taught the material from the textbook without altering their normal delivery of the material. The control group listened to the parody song (Appendix A) and were read aloud a review of the material each day. This ensured an equal amount of exposure time to the material for each group (Appendix B). Both groups were then administered a test asking them to answer questions about the textbook material. The group scores were then compared to check for any significant differences between those participants exposed to the mnemonic device and those not exposed to the mnemonic device.

Targeted Material

The targeted material consisted of the concept of the four "Ps" of marketing (place, price, promotion, and product) and the six environmental forces (competitive, technological, sociological, economical, political, and legal). This material was chosen from chapter 11 of the

Introduction to Business textbook, *Business Essentials* (Ebert & Griffin, 2017), at a large Midwestern university. The material is a concept included in the normal Introduction to Business course and is something that the professors would be teaching even if the study did not occur.

Participants

Participants included 87 college students enrolled in Introduction to Business during the 2020 fall semester at a Midwestern university. The participants were divided into four sections, as decided by the enrollment in the course's four sections. Treatment courses and control courses were determined based on enrollment in the various sections of the course, with particular consideration made toward making the two groups even. The four sections of the class met three days a week for 50-minutes per class session.

Design

This study paired a mnemonic device with a popular song to ascertain if the use of this type of memory aid helped subjects recall information both in short timeframes (within one class period) and in longer timeframes (two weeks later). The design used control and treatment groups from Introduction to Business courses at a large Midwest university. The researcher created a parody of the song “That’s What I Like,” originally performed by Bruno Mars (Appendix A; Mars et al., 2017), to be used as the mnemonic device that used the 4Ps and their definitions and the 6Fs as the lyrics to the song.

The treatment groups listened to the mnemonic device one time at the beginning of three consecutive classes. The professor was instructed to draw the students’ attention to the song but not comment about or during the song. The professors were also instructed to wait until all students were in the room and attendance had been taken before playing the mnemonic device.

The treatment condition was only given during the three class meetings, with the test given following the playing of the song on the third class meeting.

The control groups were read a review of the material at the beginning of three consecutive classes. The professors were instructed to wait until all of the students were in the room and roll had been taken before reading the review material. The control condition was only given during the three class meetings, with the test given following the reading of the review material. The researcher based the number of treatments on the previous research (Wallace, 1994; Wallace & Rubin, 1988; Yalch, 1991) in which subjects were limited in their exposure to the song. The researcher chose to have limited exposure in consideration of the time the professors gave up for the study.

The instructors for the treatment and control sections covered the targeted material through required reading in the textbook and their normal lectures. Professors were instructed to carry out their classes as usual. The control group was not exposed to the mnemonic device, while the treatment group was exposed to the mnemonic device three times. The treatment group was presented with the mnemonic device at the beginning of three separate classes. The control group was exposed to a review of the material three times, while the treatment group was not exposed to the review. The control group was presented with the review material at the beginning of three separate classes. Both the control and treatment groups were administered a test involving the principles of marketing and the six environmental forces. The test was first administered during the third class session and after three exposures to the material. The test was administered again two weeks later. Both the treatment and control groups took the test at approximately the same time of their respective classes.

Recruitment

The researcher met with all the professors of the Introduction to Business courses before administering the study. The researcher explained to them the basis for the research and the methodology. The mnemonic was provided to the professors in the form of an mp3. The researcher then met with the students and explained the study before the research began (Appendix C). Participants were informed of their rights under IRB, how to opt out of the research, and that they must be present for all parts of the study to have their data collected.

Data Collection

A test (Appendix D) was given to the subjects after the treatment period. The test was delivered via a Qualtrics survey. The first page included demographic information. The second page included the targeted material of the 4Ps and 6Fs, which were the test questions being analyzed for this study. The final page included two short answer questions regarding how the participants used or did not use mnemonic devices of any kind while taking the test. Participants in each section of the course took the test. The test was first administered during the third class session and after three exposures to the material. The test was administered again two weeks later.

The treatment group heeded the following schedule: (Class 1) completed an informed consent form (Appendix E), listened to the mnemonic device, and were assigned material in the textbook; (Class 2) listened to the mnemonic device and covered the material in the textbook; (Class 3) listened to the mnemonic device and then immediately took the test. The control group adhered to the following schedule: (Class 1) completed the informed consent (Appendix E), the professor assigned material in the textbook, and read the review; (Class 2) covered material in class and read the review; (Class 3) read the review and administered the test. This methodology matched the amount of time between the initial exposure of the targeted material and the test that the treatment group experienced. The students in both sections were informed of the exam before it was given, and the students in both groups had the same test administered two weeks after the initial administration. This additional test was included to examine participants' abilities to retain the information after two weeks from exposure and to determine, through the added free-response questions, if the mnemonic-like song helped the participants in any way.

Several protocols were implemented for the course professors to utilize the test for grading purposes in their courses and to ensure confidentiality. A cover sheet was included with each test, and the cover sheet allowed each student to put their name on the exam and indicate if they were participating in the study or not. Upon completion, a research assistant collected the tests. Only page two of the test, labeled “Graded Questions,” were photocopied, and students' names transferred to the copies. Pages one and three, labeled “Non-Graded Questions,” were not photocopied, nor were they returned to the professors. The Graded Questions were then given to the cooperating professors for their grading purposes. The original tests were assigned a number according to the student taking the test, and these were placed into the briefcase and given to the primary researcher.

The informed consent forms containing identifying information were kept by the research assistant in a locked filing cabinet. This ensured that the cooperating professors did not know who participated in the study. It also ensured that the primary researcher could not link a test to a student's name. The research assistant retained a password-protected Excel document containing the matching student and number information. This document was stored on a flash drive and locked in the researcher’s office desk. This document was not available to either the primary researcher or the cooperating professors. For the second test administration, the research assistant collected the tests and placed them into the briefcase. The research assistant then assigned numbers to each test per the previously mentioned spreadsheet. All coversheets for this version of the test were destroyed. The research assistant then placed the tests into the locked briefcase and gave them to the primary researcher. The cooperating professors did not have access to these tests. Any tests not qualifying from the original administration were destroyed. Upon completing the study, the exams were kept in the same locked briefcase for three years. After three years, the exams will be shredded. No identifying information was given to the researcher on the exams beyond knowing from which professor the exams came. The scores given to students by the professor on the original exam had no bearing in the study and were not used.

Data Analysis

Validity for the researcher-created test was measured through face validity. The measure was sent to a business professor and education professor at a large Midwestern university and two business teachers at a large Midwestern high school. Each person was asked the following questions: 1) does the quiz measure the participants' ability to recall the four Ps of marketing (price, product, promotion, and place)?; 2) does the quiz measure the participants' ability to recall the definitions of those 4 Ps of marketing?; 3) does the quiz measure the participants' ability to recall the six environmental forces (competitive, technological, sociological, economical, political, and legal)?; 4) does the measure accurately measure the information sought in the four research questions guiding this study; and 5) does the mnemonic device provide the information to the participants in a way which could be helpful?

All the reviewers agreed that the quiz measured the participants' ability to recall the information regarding the four Ps and the six environmental forces. One question was raised about the design's effectiveness in encoding information into long-term memory regarding the definition of long-term memory. It was advised to define long-term memory for this study as being two weeks. The reviewers also agreed that the information provided in the mnemonic device was accurate and could, in theory, help participants to recall the information for the researcher-created test. The quiz was also validated through the collaboration of the researcher with the business professors used in the study to create the measure.

Reliability for the researcher-created test was measured through a test-retest procedure. A Pearson product-moment correlation coefficient was calculated to assess the reliability of the measure. The correlation was calculated through comparing the total scores on the two administrations of the test. There was a significant moderate positive reliability found for the researcher created test, $r = .571$, $N = 87$, $p = .00$. While the reliability coefficient is not as high as expected, this can be explained by Collins (2007) who found that while the test-retest procedure for measuring reliability has become a standard procedure, it makes an assumption that what is being measured does not change over time. Collins (2007) asserted that when the participants experience a change a varying types and magnitudes between the separate administrations of the measure, the reliability may be low even when the measurement itself is very reliable. The students in the current research were presumably enrolled in a wide variety of other courses ranging in all levels of difficulty. The varying rate of change in the participants, through learning new material to studying for tests in other classes at various times, could explain the moderate reliability score.

Descriptive statistics were collected and analyzed from the non-graded questions. This included demographic information. The demographic statistics for the participants in this study were also compared to the descriptive statistics of the overall student population of Large Midwestern University through a chi-square analysis. The descriptive statistics for the general population of Large Midwestern University were taken from the President's Council on Inclusive Excellence 12th Annual Report (Large Midwestern University, 2020).

In order to rule out any of the descriptive data from having a significant effect on the participants' test scores, an analysis of variance was performed. Each descriptive statistic was used as an independent variable to analyze differences to determine if it predicted a difference. These procedures set up the validity of using the treatment group as the only grouping variable in the following doubly multivariate analysis of variance.

A doubly-multivariate analysis of variance was performed on 4Ps test scores and 6Fs test scores over two time periods. The four Ps were product, price, place, and promotion. The six environmental forces were competitive, technological, sociological, economical, political, and legal. The list of the 4Ps and the definition of the 4Ps created a single score. If the definition did not match the correct P, it was considered to be incorrect. Test items were separated into two categories: the four P's and their definitions (4Ps) and the six environmental forces list (6Fs). These categories were the same for both administrations of the test. The 4Ps category only included question six (Appendix D): list and then describe the 4Ps. The 6Fs category only included question eight: list the six environmental forces. Questions seven (what is another term that can be used in place of the 4ps) and nine (when any of the environmental forces change, what must also change) were excluded from the analysis as they were questions requested by the Introduction to Business professors and did not pertain to the research questions of this study. The scores for each of these categories were transformed to percentages for analysis.

Group assignment was the between-subjects factor: (a) treatment and (b) control. The within-subjects factor was time periods: (a) immediately following the third presentation of the targeted material and (b) two weeks after the initial test. Administration one of the test occurred immediately following the review being read aloud during the third class for the control group and immediately following the playing of the song for the treatment group. Administration two occurred two weeks after the first administration. The second administration was not preceded by either the playing of the song or the verbal review. These two points in time were chosen to determine the effectiveness of the mnemonic device immediately following its hearing and its effectiveness after a period of time without hearing it.

A doubly multivariate analysis of variance (MANOVA) was also conducted to test whether musical experience significantly affected a subject's ability to recall information. Instrumental music experience was the between-subjects factor: (a) less than or equal to three years and (b) more than three years. The within-subjects factor was time periods: (a) immediately following the third presentation of the targeted material and (b) two weeks after the initial test. Years of instrumental musical experience were recoded to have groups of three or fewer years and four or more years of experience. As the questionnaire did not require participants to indicate when the years of musical experience took place, the data were broken down in this manner as a general estimate of those students who had taken music classes while in high school. This generalization of students with more than three years of instrumental musical experience would indicate that students took music through their high school careers and thus were trained with more advanced musical concepts, while those with less than four years of experience would not.

The analysis was used to determine any significant differences in participants' abilities to recall the simple list of terms, as has been studied in much of the previous research (Balch et al., 1992; Moore et al., 2008; Rainey & Larsen, 2002; Smith, 1985; Thaut et al., 2014). This is seen in questions six through nine. The analysis also examined if the participants could remember the definitions associated with the terms. This type of research is lacking in the literature. The analysis helped determine if the amount of repetition utilized in the mnemonic device factored into the participants’ ability to recall the words. The four Ps were repeated multiple times in the mnemonic device, while the environmental forces were only mentioned once.

The procedures selected for data analysis were chosen to help avoid any Type I or Type II error. The doubly multivariate analysis of variance (MANOVA) was chosen to analyze all the data in one omnibus test. An omnibus measure as the starting point allowed for an overall examination of differences without having to conduct repeated tests.

CHAPTER 4

RESULTS

This chapter contains the results of the study conducted to answer the research questions:

1) Was using a pop song parody as a mnemonic rehearsal technique more effective in helping students correctly name more of the 4Ps, define more of the 4Ps, and correctly name more 6Fs than the control group taught more traditionally?

2) Did the pop song parody used as a mnemonic rehearsal technique aid in recalling information two weeks after instruction versus at the point of instruction?

3) Is there a significant difference in a subject's ability to recall information when it is presented in either a single or repeated exposure to the musical mnemonic?

4) Does instrumental musical experience significantly affect a subject's ability to recall information when a musical mnemonic is used in instruction?

Additionally, this chapter provides sample demographics with complementary tables. The data analysis was conducted using a doubly multivariate MANOVA. Utilizing a doubly multivariate MANOVA ensured that all of the data were analyzed using only one meta-analysis technique. This helped to reduce the possibility of a type II error in the research.

Descriptive Statistics

There were a total of 87 participants meeting all the requirements for participation in the study. Their overall test scores as a group and broken down by treatment group and control group are presented in Table 1.

Table 1

Overall Test Scores Broken Down by Overall Group, Treatment Group, and Control Group

Test	Group	*N*	*M*	Median	Min.	Max	Skew.	Kurt.
Test 1	Treatment	45	9.96	10.00	3.00	15	-.150	-.615
	Control	42	11.79	14.00	0.00	16	-1.382	1.249
	Overall	87	10.84	11.00	0.00	16.00	-.725	-.038
Test 2	Treatment	45	7.87	7.00	0.00	16.00	.261	-.638
	Control	42	9.81	11.00	0.00	15.00	-.707	-.396
	Overall	87	8.80	9.00	0.00	16.00	-.180	-.886

It is noteworthy to highlight the skewness of the control group on test 1. This indicated that few participants scored poorly on test 1 in the control group. This is most likely attributed to a ceiling effect. The material covered in the measure is material includes terminology that is central to business concepts and is information that will be needed throughout the participants' course of study. There were also three outlier scores for the control group. When the outlier scores are removed, the skewness falls to within acceptable levels for using parametric procedures (Table 2). Thus, the finding that the mean score for the control group was high (11.79) and that the skew was negative, indicating that a large number of participants scored well on the measure, was not unusual. It should also not be unreasonable to therefore use parametric procedures moving forward.

Table 2

Overall Test Scores for Test 1 With the Outliers Removed

Test	Group	*N*	*M*	Median	Min.	Max	Skew.	Kurt.
Test 1	Treatment	45	9.96	10.00	3.00	15	-.150	-.615
	Control	37	13.08	14.00	8	16	-.635	-.944
	Overall	82	11.56	11.00	3	16.00	-.356	-.817

These participants self-identified as 47 (54%) male and 40 (46%) female (Table 3).

Table 3

Sex Comparison Between Study Participants and University Undergraduate Population

	Study Participants	University Undergraduate Population
Male	47 (54%)	3,844 (43%)
Female	40 (46%)	5,095 (57%)

Note. University undergraduate total taken from the President's Council on Inclusive Excellence 12th Annual Report (Large Midwestern University, 2020).

A recent Wall Street Journal (Belkin, 2021) stated that females comprise 59.9% of college students in the United States. This statistic is also represented in the population of Large Midwestern University, as reported by the President's Council on Inclusive Excellence 12th Annual Report (Large Midwestern University, 2020). While females make up the majority of students in colleges and universities, this is not the case for colleges of business in the United

States. According to The Economist Newspaper (2016), females only comprise 34% of students in colleges of business. This statistic also helps explain the difference between the population of the undergraduate institution as a whole and the college of business participants in the current study.

Participants self-identified as 69 (79%) White/Caucasian, 5 (6%) Hispanic/Latino, 12 (14%) Black/African-American, and 1 (1%) Asian (Table 4).

Table 4

Race Comparison Between Study Participants and University Undergraduate Population

	Study Participants	University Undergraduate Population
White/Caucasian	69 (79%)	6,174 (69%)
Black/African-American	12 (14%)	1,535 (17%)
Hispanic/Latino	5 (6%)	509 (6%)
Asian	1 (1%)	140 (2%)

Note. University undergraduate total taken from the President's Council on Inclusive Excellence 12th annual report (Large Midwestern University, 2020).

These self-reported group membership by race numbers were comparable to the overall student body of Indiana State University, X^2 (1, N = 87) = 7.41, p = .11571. In comparing race and sex, participants self-identified as 37 (43%) White/Caucasian male, 32 (37%) White/Caucasian female, 2 (2%) Hispanic/Latino male, 3 (3%) Hispanic/Latino female, 8 (9%) Black/African-American male, 4 (5%) Black/African-American female, and 1 (1%) Asian female (Table 5).

Table 5

Breakdown of Study Participants by Race and Sex

	Male	Female
White/Caucasian	37 (43%)	2 (2%)
Black/African-American	8 (9%)	4 (5%)
Hispanic/Latino	2 (2%)	8 (9%)
Asian	0 (0%)	1 (1%)

The treatment group participants (*n* = 45) self-identified as 35 (78%) White/Caucasian, 8 (18%) Black/African-American, 1 (2%) Hispanic/Latino, and 1 (2%) Asian. Regarding sex, the treatment group self-identified as 24 (53%) male and 21 (47%) female participants. In comparing race and sex, the treatment group participants self-identified as 20 (44%) White/Caucasian males, 15 (33%) White/Caucasian females, one (2%) Hispanic/Latino female, four (8%) Black/African-American males, four (8%) Black/African-American females, and one (2%) Asian female. The control group participants (*n* = 42) self-identified as 34 (80%) White/Caucasian, four (9%) Black/African-American and 4 (9%) Hispanic/Latino participants. The control group self-identified as 23 (55%) male and 19 (45%) female participants. The control group participants self-identified as 17 (40%) White/Caucasian males, 17 (40%) White/Caucasian females, 2 (28%) Hispanic/Latino males, 2 (28%) Hispanic/Latino females, and 4 (9%) Black/African-American males.

There were four participating professors in this study, each teaching one section of Introduction to Business. Professor one, who taught a treatment group section, had 18 (78%) White/Caucasian and five (22%) Black/African-American self-identified participants (*n* = 23).

This class included 13 (57%) self-identified male and 10 (43%) self-identified female participants. Professor one's participants self-identified as 11 (48%) White/Caucasian males, 7 (30%) White/Caucasian females, 2 (9%) Black/African-American males, and 3 (13%) Black/African-American females.

Professor two, who taught a control group section (*n* = 16), had 14 (88%) White/Caucasian and two (12%) Black/African-American self-identified participants. This class included 12 (75%) male and four (25%) female self-identified participants. Professor two's participants self-identified as 10 (63%) White/Caucasian males, 4 (25%) White/Caucasian females, and 2 (12%) Black/African-American males.

Professor three, who taught a treatment group section, had 17 (77%) White/Caucasian, one (5%) Hispanic/Latino, 3 (14%) Black/African-American, and 1 (5%) Asian self-identified participants (*n* = 22). This class included 11 (50%) self-identified male and 11 (50%) self-identified female participants. Professor three's participants self-identified as 9 (41%) White/Caucasian males, 8 (36%) White/Caucasian females, 1 (5%) Hispanic/Latino female, 2 (9%) Black/African-American males, 1 (5%) Black/African-American females, and 1 (5%) Asian female.

Professor four, who taught a control group section, had 20 (77%) White/Caucasian, 4 (15%) Hispanic/Latino, and 2 (8%) Black/African-American self-identified participants (*n* = 26). This class included 11 (42%) self-identified male and 15 (58%) self-identified female participants. Professor four's participants self-identified as 7 (27%) White/Caucasian males, 13 (50%) White/Caucasian females, 2 (8%) Hispanic/Latino males, 2 (8%) Hispanic/Latino females, and 2 (8%) Black/African-American males. A breakdown of the participants' race by professor is presented in Table 6.

Table 6

Racial Breakdown of Professor Sections

	Prof. 1	Prof. 2	Prof. 3	Prof. 4
White/Caucasian	18 (78%)	14 (88%)	17 (77%)	20 (77%)
African American	5 (22%)	2 (12%)	3 (14%)	2 (8%)
Hispanic/Latino	0 (0%)	0 (0%)	1 (5%)	4 (15%)
Asian	0 (0%)	0 (0%)	1 (5%)	0 (0%)

Note. A breakdown of participants' sex by professor is found in Table 7.

Table 7

Breakdown of Participants' Sex by Professor

	Prof. 1	Prof. 2	Prof. 3	Prof. 4
Male	13 (57%)	12 (75%)	11 (50%)	11 (42%)
Female	10 (43%)	4 (25%)	11 (50%)	15 (58%)

It is important to note that the researcher had no expectations that the students would have any musical experience to take the Introduction to Business class. However, many students are required to take a fine arts class in high school or college. Many students also participate in music ensembles such as band, orchestra, or choir throughout their high school and college careers. A question asking if the participants had taken a music class was used for descriptive data only. More participants in the treatment group indicated that they had taken a music class (n = 28) than had not (n = 17). However, fewer participants in the control group indicated that they had taken a music class (n = 18) than had not (n = 24).

The average age of all students was 18.67 years old, with the youngest subject being 17 years of age (*n* =1) and the oldest subject being 24 years of age (*n* = 1). Breakdowns of age for both treatment and control groups (Table 8) are below.

Table 8

Age by Group

	N	*M*	*SD*	*Mdn*	Min	Max
Treatment	45.00	18.64	1.32	18.00	17.00	24.00
Control	42.00	18.69	0.92	18.00	18.00	22.00
Total	87.00	18.67	1.14	18.00	17.00	24.00

More treatment participants (*n* = 28) indicated that they had taken at least one music class in high school or college than had not (*n* = 17). However, fewer control participants (*n* = 18) indicated that they had taken at least one music class in high school or college than had not (*n* = 24). A chi-square test of independence was performed to examine if there was a significant difference between groups in whether or not participants had taken a music class or not. The difference between these variables was not significant, X^2 (1, *N* = 87) = .29, p = .592. This indicated that there was no difference between the expected frequencies and the observed frequencies between the groups. Thus, there was no significant difference between treatment and control based on the amount of experience.

Test Scores

Total test scores for the purpose of this study were calculated by combining the correct answers on the 4Ps and 6Fs questions (Appendix D). This decision was made as the remaining questions in the test were created by the participating professors for the purposes of the respective classes. Those questions were not part of the targeted material used in this study. A breakdown of total tests scores grouped by sex is presented in Table 9.

Table 10

Total Test Scores by Sex

		N	Mean	Std. Dev.	Std. Err.	Min	Max
Test 1	Male	47	10.79	3.65	.53	2	16
	Female	40	10.90	4.14	.66	0	16
	Total	87	10.84	3.86	.41	0	16
Test 2	Male	47	8.74	4.07	.59	0	15
	Female	40	8.88	4.18	.66	0	16
	Total	87	8.80	4.10	.44	0	16

A one-way analysis of variance (ANOVA) was conducted to compare the effect of sex on total scores for tests one and two. No significance was discovered, $F(1, 85) = .02$, $p = .893$, for either test one or test two, $F(1,85) = .02$, $p = .883$. This indicates that a participant's score was not dependent on their sex.

Total test scores grouped by professors are presented in Table 10.

Table 10

Total test scores by professor group

		N	Mean	Std. Dev.	Std. Err.	Min	Max
Test 1	Prof. 1	23	10.26	2.78	.58	3	15
	Prof. 2	16	11.56	4.44	1.11	1	16
Test 1	Prof. 3	22	9.64	3.71	.79	4	15

		N	Mean	Std. Dev.	Std. Err.	Min	Max
	Prof. 4	26	11.92	4.23	.83	0	16
	Total	87	10.84	3.86	.41	0	16
Test 2	Prof. 1	23	8.22	3.06	.64	4	14
	Prof. 2	16	10.50	4.55	1.14	0	15
	Prof. 3	22	7.50	4.23	.90	0	16
	Prof. 4	26	9.38	4.25	.83	1	15
	Total	87	8.80	4.10	.44	0	16

An ANOVA was conducted to compare the effect of the professor on total scores for tests one and two. No significance was discovered, $F(3, 83) = 1.803$, $p = .153$, for either test one or test two, $F(3,83) = 2.061$, $p = .112$. This indicates that the individual professors did not significantly affect the total scores of the participants. While the initial descriptive statistics in Tables 1 and 2 indicated a possibility of the professors affecting the scores, this more in depth ANOVA shows otherwise.

Total test scores for participants grouped by race are presented in Table 11.

Table 11

Total test scores grouped by race

		N	Mean	Std. Dev.	Std. Err.	Min	Max
Test 1	White/Caucasian	69	10.72	3.99	.48	0	16
	Black/African-American	12	12.08	2.35	.68	9	16
	Hispanic/Latino	5	9.80	5.26	2.35	4	15
	Asian	1	9.00	-	-	9	9

		N	Mean	Std. Dev.	Std. Err.	Min	Max
Test 1	Total	87	10.84	3.86	.41	0	16
Test 2	White/Caucasian	69	8.88	4.28	.52	0	16
	Black/African-American	12	9.75	3.11	.90	4	14
	Hispanic/Latino	5	5.60	2.61	1.17	2	8
	Asian	1	8.00	-	-	8	8
	Total	87	8.80	4.10	.44	0	16

An ANOVA was conducted to compare the effect of race on total scores for tests one and two. No significance was discovered, $F(3, 83) = .624$, $p = .602$, for either test one or test two, $F(3,83) = 1.266$, $p = .292$. This indicates that the race of a participant did not significantly affect the total scores of the participants.

Total test scores for students grouped by whether or not they had taken a music class (band, orchestra, or choir) in either high school or college are presented in Table 12. This descriptive question was only used as a demographic question. A follow-up question concerning the number of years of experience a participant had in instrumental music was used as a more plausible factor in affecting participant test scores.

Table 12

Test Scores by Participation in a Music Class

		N	Mean	Std. Dev.	Std. Err.	Min	Max
Test 1	Took A Class	46	10.35	3.95	.58	0	16
	Did Not Take A Class	41	11.39	3.73	.58	1	16
Test 1	Total	87	10.84	3.86	.41	0	16

		N	Mean	Std. Dev.	Std. Err.	Min	Max
Test 2	Took A Class	46	8.20	4.21	.62	0	16
	Did Not Take A Class	41	9.49	3.90	.61	0	15
	Total	87	8.80	4.10	.44	0	16

An ANOVA was conducted to compare the effect of participation in a music class on total scores for tests one and two. No significance was discovered, $F(1, 85) = .1.591$, $p = .211$, for either test one or test two, $F(1,85) = 2.186$, $p = .14$. This indicates that participation in a music class did not significantly affect the total scores of the participants.

With all the individual grouping categories being ruled statistically insignificant in affecting the scores of the participants, these grouping variables were eliminated from further statistical procedures regarding the test scores. Based on finding no significant differences in test scores based on the demographic grouping variables described above, the researcher chose to exclude them and focus on the remaining variables in the research that follows.

Treatment Versus Control Groups

Test items were separated into two categories: the four P’s and their definitions (4Ps) and the six environmental forces list (6Fs). The four Ps are product, price, place, and promotion, and the six environmental forces are competitive, technological, sociological, economical, political, and legal. These categories were the same for both administrations of the test. The 4Ps were presented multiple times in the musical mnemonic as opposed to the 6Fs, which were only presented a single time. Administration one of the test for the control group occurred immediately following the review being read aloud during the third class. Administration two occurred two weeks after the third class. These two points in time were chosen to determine the effectiveness of the mnemonic device immediately following its hearing and its effectiveness after a period of time without hearing it.

A doubly-multivariate analysis of variance was performed on 4Ps test scores and 6Fs test scores over two time periods. Group assignment was the between-subjects factor: (a) treatment and (b) control. The within-subjects factor was time periods: (a) immediately following the third presentation of the targeted material and (b) two weeks after the initial test. The sample size for the treatment group was 45, and the sample size for the control group was 42. No data were missing, and no outliers were found. Cell means and standard deviations for the two DVs across all time periods are reported in Table 13.

Table 13

Treatment and Control Group Test Scores Over all Time Periods

	Treatment or Control	Mean	Std. Dev.	N
4Ps Test 1	Treatment	.83	.23	45
	Control	.80	.30	42
	Total	.81	.26	87
4Ps Test 2	Treatment	.62	.27	45
4Ps Test 2	Control	.62	.28	42
	Total	.62	.28	87
6Fs Test 1	Treatment	.39	.43	45
	Control	.77	.39	42
	Total	.58	.45	87
6Fs Test 2	Treatment	.34	.42	45

	Treatment or Control	Mean	Std. Dev.	N
6Fs Test 2	Control	.71	.39	42
	Total	.52	.44	87

Results indicated no significant interaction effect between time and group on the scores (F(2, 84) = .23, p = .80, Wilks' Λ = 1.00, partial η^2 = 01). There was a statistically significant between-subjects effect for treatment versus control group (F(2, 84) = 11.81, p < .05, Wilks' Λ = .78, partial η^2 = .22). This was apparent in the difference of the means on the 6Fs between the treatment and control groups. However, this was not as dramatically different on the means for the 4Ps scores. Results also indicated a statistically significant within-subjects effect for time (F(2, 84) = 20.63, p < .05, Wilks' Λ = .67, partial η^2 = .33). These results are presented in Table 14.

Table 14

Multivariate Results Based on Treatment Group

Effect			Value	*F*	Hyp. *df*	Error *df*	Sig.	Partial η^2
Between	Intercept	Wilks' Λ	.089	430.616	2.000	84.000	.000	.911
Subjects	Group	Wilks' Λ	.780	11.812	2.000	84.000	.000	.220
Within	Time	Wilks' Λ	.671	20.628	2.000	84.000	.000	.329
Subjects	Time* Group	Wilks' Λ	.995	.225	2.000	84.000	.799	.005

Two follow up univariate mixed ANOVAs, one for each dependent variable, were calculated and a Bonferroni correction was used ($\alpha = .025$). This correction was used due to the increased risk of a type I error when using multiple measures on one set of data. These univariate mixed ANOVAs were calculated to examine which individual dependent variable differed between groups. For the 4Ps, univariate ANOVA results indicated that there was not a statistically significant interaction effect between time and group within-subjects on scores, (F(1, 85) = .24, p = .62, partial η^2 = .00). There was a significant within-subjects effect (F(1, 85) = 41.31, p < .025, partial η^2 = .33). Participants on average scored significantly higher on the 4Ps on the first administration of the test (M = .81) than the second (M = .62). There was no statistically significant between-subjects effect on the 4Ps, (F(1, 85) = .13, p = .72, partial η^2 = .00).

For the 6Fs, mixed ANOVA results there was not an interaction effect between time and group within-subjects on the 6Fs scores, (F(1, 85) = .07, p = .79, partial η^2 = .00). There was also no statistically significant within subjects effect (F(1, 85) = 2.47, p = .12, partial η^2 = .03). Participants on average scored higher but not significantly on the 6Fs on the first administration (M = .58) than the second (M = .52). There was a statistically significant between-subjects effect on the 6Fs, (F(1, 85) = 22.20, p = .00, partial η^2 = .21. Subjects in the control group scored significantly higher on the 6Fs (M = .77 and .71) than the subjects in the treatment group (M = .39 and .34).

In summary, results indicated that both the treatment and control groups scored similarly on the 4Ps on both administrations of the test. However, the control group appeared to fare significantly better on the 6Fs on both administrations than the treatment group. There did appear to be a difference in the scores from the first administration of the test to the second administration of the test on the 4Ps scores. Participants in both groups scored higher on the first administration than the second. However, time did not appear to affect the scores on the 6Fs portion of the test with either group.

Instrumental Music Experience

The average number of years of experience playing a musical instrument for all participants was 2.45 years, with 35 students (40.2%) having listed no years of experience (Table 3). The greatest number of years playing a musical instrument reported was 15 years by one student (Table 15).

Table 15

Instrumental Experience by Subject

	Treatment	Control	Total
0 Years	14.00	22.00	35.00
1 Year	7.00	5.00	12.00
2 Years	5.00	3.00	8.00
2.5 Years	1.00	0.00	1.00
3 Years	4.00	3.00	7.00
4 Years	2.00	1.00	3.00
5 Years	3.00	2.00	5.00
6 Years	1.00	3.00	4.00
7 Years	4.00	2.00	6.00
8 Years	2.00	1.00	3.00
10 Years	1.00	1.00	2.00
15 Years	1.00	0.00	1.00

	Treatment	Control	Total
M	2.88	2.00	2.45
SD	3.33	2.76	3.08

Years of instrumental musical experience were recoded to have groups of three or fewer years and four or more years of experience. As the questionnaire did not require participants to indicate when the years of musical experience took place, the data were broken down in this manner as a general estimate of those students who had taken music classes during their high school careers. As identified earlier, this follow-up question was a more specific music education question regarding the number of years of experience playing a musical instrument. The researcher proposed that this may have a significant bearing on the participants' ability to recall the information. With instrumental music instruction generally beginning in middle school, this statistic would also indicate that these participants completed their instrumental programs from beginners through high school. This generalization of students with more than three years of instrumental musical experience would indicate that students took music through their high school careers and thus have trained with more advanced musical concepts, while those with less than four years of experience would not. Table 16 shows the descriptive statistics of the participants broken down by years of musical experience.

Table 16

Years of Musical Experience by Range

	3 or Fewer Years	4 or More Years
Treatment	31 (69%)	14 (31%)
Control	32 (76%)	10 (24%)

	3 or Fewer Years	4 or More Years
Total	63 (72%)	24 (28%)

A second doubly multivariate analysis of variance was also performed on the 4Ps test scores and 6Fs test scores over two time periods, with instrumental music experience being used as the grouping variable. Instrumental music experience was the between-subjects factor: (a) less than or equal to three years and (b) more than three years. The within-subjects factor was time periods: (a) immediately following the third presentation of the targeted material and (b) two weeks after the initial test. The sample size for those participants with three or fewer years of instrumental musical experience was 63 and the sample size for those participants with more than three years of instrumental musical experience was 24. Due to the unequal sizes of the groups, a more stringent expectation of $p < .025$ for significance was used. No data were missing, and no outliers were found. Cell means and standard deviations for the two DVs across all time periods are reported in Table 17.

Table 17

Descriptive Statistics for Test Scores Grouped by Instrumental Musical Experience

	Inst. Exp.	Mean	Std. Dev.	N
4Ps Test 1	≤ 3 Years	.80	.25	63
	> 3 Years	.84	.29	24
	Total	.81	.26	87
4Ps Test 2	≤ 3 Years	.62	.25	63
	> 3 Years	.60	.35	24

	Inst. Exp.	Mean	Std. Dev.	N
4Ps Test 2	Total	.62	.28	87
6Fs Test 1	≤ 3 Years	.59	.45	63
	> 3 Years	.54	.45	24
	Total	.58	.45	87
6Fs Test 2	≤ 3 Years	.57	.44	63
	> 3 Years	.39	.41	24
	Total	.52	.44	87

The number of years of instrumental musical experience by time interaction was not statistically significant, ($F(2, 84) = 1.35$, $p = .264$, Wilks' $\Lambda = .97$, partial $\eta^2 = .31$. The between-subjects effect of years of instrumental music experience was also not statistically significant, ($F(2,84) = .11$, $p = .49$, Wilks' $\Lambda = .98$, partial $\eta^2 = .02$). However, the within-subjects effect of time did have a statistically significant effect, ($F(2, 84) = 18.71$, $p < .025$, Wilks' $\Lambda = .69$, partial $\eta^2 = .31$). These results are presented in Table 18.

Table 18

Multivariate Results Based on Instrumental Musical Experience

Effect			Value	*F*	Hypothesis *df*	Error *df*	Sig.	Partial η^2
Between	Intercept	Wilks' Λ	.110	338.215	2.000	84.000	.000	.890
Subjects	MusExp	Wilks' Λ	.983	.727	2.000	84.000	.486	.017

Effect			Value	*F*	Hypothesis *df*	Error *df*	Sig.	Partial η^2
Within	Time	Wilks' Λ	.692	18.705	2.000	84.000	.000	.308
Subjects	Time* MusExp	Wilks' Λ	.969	1.353	2.000	84.000	.264	.031

Two follow up univariate mixed ANOVAs, one for each dependent variable, were calculated and a Bonferroni correction was used (α = .25). These univariate mixed ANOVAs were calculated to examine which individual dependent variable was different between administrations. For the 4Ps, univariate ANOVA results indicated that there was not a statistically significant interaction effect between time and group within-subjects on scores, (F(1, 85) = .691, p = .41, partial η^2 = .01). There was a significant within-subjects effect (F(1, 85) = 37.84, p = .00, partial η^2 = .31). Participants on average scored significantly higher on the 4Ps on the first administration of the test (M = .81) than the second (M = .62). This was a result already found in the previous doubly multivariate results. There was no statistically significant between-subjects effect on the 4Ps, (F(1, 85) = .03, p = .87, partial η^2 = .00).

For the 6Fs mixed ANOVA results, there was not an interaction effect between time and group within-subjects on the 6Fs scores, (F(1, 85) = .2.64, p = .41, partial η^2 = .01). There was also no statistically significant within-subjects effect (F(1, 85) = 4.61, p = .04, partial η^2 = .51). Participants on average did not score significantly higher on the 6Fs on the first administration (M = .58) than the second (M = .52). There was also not a statistically significant between-subjects effect on the 6Fs, (F(1, 85) = 1.35, p = .25, partial η^2 = .16.

In summary, the number of years of instrumental musical experience appeared to have no statistically significant effect on participants' ability to recall either the 4Ps or the 6Fs at either point in time of test administration. Even though there was a significant finding with regard to subjects' scores on the 4Ps for the first administration versus the second administration, this was already explored with the data used in the previous doubly multivariate MANOVA. This finding was among all subjects and was not statistically due to the number of years of musical experience.

Summary

With regard to the research questions, the results indicated that the use of a pop song parody used as a mnemonic rehearsal technique did not help students to retain the information long-term, as measured two weeks following the initial test, compared to no memory aid. Results indicated that the pop song parody used as a mnemonic rehearsal technique did not aid in recalling information two weeks after instruction versus at the point of instruction. Results, based on the difference between the scores on the 4Ps and the 6Fs, also indicated that there was a significant difference in a subject's ability to recall information when it was presented as a single versus repeated exposure in the musical mnemonic. These results potentially indicated that the repeated exposure material was more effectively recalled than the single exposure material. However, other factors likely also influenced this finding. Those factors will be discussed in greater detail in a later chapter. Finally, the results indicated that instrumental musical experience did not significantly affect a participant's ability to recall information when a musical mnemonic was used in instruction.

CHAPTER 5

DISCUSSION

The purpose of this study was to examine if using a popular song with rewritten lyrics as a mnemonic device is more effective in aiding students' recall of information than traditional lecture delivery. This chapter discusses significant findings related to the literature examining cognitive load theory, working memory, information recall, prose and text recall, music memory in marketing and advertising, music as background sound, memory recall with participants with mental disabilities, and recall of information using mnemonic-like songs. Also included is a discussion on connections to this study with memory recall theories. This chapter concludes with a discussion of the limitations of the study, areas for future research, and a summary.

This chapter will discuss the research findings and future research possibilities for the following research questions:

1) Was using a pop song parody as a mnemonic rehearsal technique more effective in helping students correctly name more of the 4Ps, define more of the 4Ps, and correctly name more 6Fs than the control group taught more traditionally?

2) Did the pop song parody used as a mnemonic rehearsal technique aid in recalling information two weeks after instruction versus at the point of instruction?

3) Is there a significant difference in a subject's ability to recall information when it is presented in either a single or repeated exposure to the musical mnemonic?

4) Does instrumental musical experience significantly affect a subject's ability to recall information when a musical mnemonic is used in instruction?

Review of Methodology

Participants included 87 students enrolled in an Introduction to Business course. They were divided into treatment and control groups. The targeted material was the 4Ps and 6Fs of marketing from chapter 11 of the Introduction to Business textbook, *Business* Essentials (Ebert & Griffin, 2017). Over the course of three classes the control group was provided a spoken review of the material. During the first class, the professors also assigned the chapter to the participants. During the second class, the professors also provided the participants with a lecture over the material. After the spoken review during the third class, the participants took the researcher created test. Two weeks following the administration of the test, the control group took the same test.

Over the course of three classes the treatment group was provided a mnemonic-like pop song featuring the material. During the first class, the professors also assigned the chapter to the participants. During the second class, the professors also provided the participants with a lecture over the material. After the mnemonic-like pop song during the third class, the participants took the researcher created test. Two weeks following the administration of the test, the treatment group took the same test.

Review of Results

With regards to the research questions, the results indicated that in this study the use of a pop song parody used as a mnemonic rehearsal technique was not significantly effective in helping students recall information two weeks following the initial test, compared to no memory aid. Results of this study indicated that the pop song parody used as a mnemonic rehearsal technique did not appear to aid in recalling information two weeks after instruction versus at the point of instruction. Results of this study did indicate a significant difference in a subject's ability to recall information when presented as a single versus repeated exposure in the musical mnemonic. These results indicated that the repeated exposure material was more effectively recalled than the single exposure material. Finally, the results indicated that instrumental musical experience did not significantly affect a participant's ability to recall information when a musical mnemonic was used in instruction.

Conclusions

Through the course of this study, certain aspects of how the pop song was used as a mnemonic appeared to have affected the participants' ability to encode and remember information both immediately after the presentation of the information and two weeks after the presentation. Each of these aspects is described in detail below. These will also be compared to previously conducted research and their findings.

This study indicated that using a pop song as a mnemonic device neither significantly helped students remember information immediately following the presentation of the information, nor significantly helped students remember information two weeks after the presentation of the information. These findings both correlate with research findings on cognitive load theory and contradict the research on the use of mnemonic devices as memory aids. Cognitive load theory correlates with the research findings as the mnemonic device used was much longer than the approximate 30 seconds of duration that this theory asserts the brain is able to store and process at one time (Baddeley, 1986; Barrett et al., 2004; Cowan, 2001; Miller, 1956; Ormrod, 2020). However, the previous research on the use of mnemonic devices as memory aids, especially when they are paired with music, was found to help participants to recall information more easily (Calvert & Tart, 1993; Rainey & Larson 2002; Wallace, 1994).

Cognitive load theory asserts that there is a limit to how much new information the brain can process at one time and that there are no known capacity limits to how much information the brain can store. The theory holds that the human brain has a short-term working memory that is limited in capacity to 4 ± 1 pieces of information (Baddeley, 1986; Barrett et al., 2004; Cowan, 2001; Miller, 1956; Ormrod, 2020) and a limited duration of approximately 30 seconds (Cowan, 1988; Ormrod, 2020; Peterson & Peterson, 1959) when dealing with new information. This would also be supported in the current study, given that the information participants were being asked to remember included 10 terms and four definitions for a total of 14 pieces of information. Also, the mnemonic device and the recall task used in the present study were much longer than 30 seconds. Without the active rehearsal of information, short-term memory has been generally found to be between 15 and 20 seconds (Cowan, 1988; Ormrod, 2020; Peterson & Peterson, 1959).

The current study also relied on the split attention, modality, and redundancy strategies of improving the transfer of information from short-term to long-term memory. Regarding split attention, the results of this study do not appear to coincide with the results of studies pairing the recall of lists of words when those lists are presented to the subject with background music (Balch et al., 1992; Smith, 1985). Both of these studies found that background music, regardless of the tempo or length, aided participants' abilities to recall lists of words. The difference in the results may have been in the pairing of the word lists with music as lyrics rather than just including the music as background sound. The music utilized in the current study was not used as background music, but was instead, used as part of the mnemonic device itself. Whereas in the

Balch et al. (1992) and the Smith (1985) studies, the music was simply background music paired with word lists, the music used in the current study was the word list. The current study's music provided a specific melody and pattern to be paired with the word lists rather than just something to listen to while listening to or reading the word list. This may have played a role in the differing results found in the current study.

With regard to the modality approach to cognitive load theory, the results again contradict the previous research. Previous researchers (Baddeley, 1983, 2002; Baddeley & Hitch, 1974; Jeung et al., 1997; Mousavi et al., 1995; Penney, 1989; Tindall-Ford et al., 1997) concluded that the use of both an auditory stimulus as well as a visual stimulus would help to circumvent the cognitive restrictions with regard to load and aid students' ability to recall more information. However, the current study did not provide participants with the lyrics to the mnemonic device. While participants had the information presented in the mnemonic device in their textbooks, it is possible that the lack of a visual component for the mnemonic device played a role in their ability, or inability, to recall a significant amount of information.

Future research would benefit from allowing the students to have a written copy of the lyrics to the mnemonic device in front of them while listening to the song. Students could also have only the salient information in front of them (the word and definition lists) during the hearing of the song. This could be facilitated through either a printed version or the lyrics or lists could be presented on a PowerPoint slide at the front of the class. The professors could also compare the lyrics with the main ideas of the chapter and the tested material, pointing out the parts of the songs that reinforce the material from the textbook.

It is likely that the redundancy effect of cognitive load theory significantly impacted the results of this study. Recall that the redundancy effect is when information in multiple forms or unnecessary information needed for the current task is presented to the learner (Bobis et al., 1994; Chandler & Sweller, 1991; Mayer et al., 1996; Sweller, 2016; Torcasio & Sweller, 2010). This research would seem to assert that the mnemonic device used in the current study was more of a hindrance or distraction to participants rather than an aid, or maybe that the participants needed something more than just a passive playing of the mnemonic device. Perhaps an active rehearsal of the mnemonic by the participants could have helped transfer the information from short-term to long-term memory. Active rehearsal could include chanting or rapping through either the entire mnemonic song or only through the salient information. In a class setting outside of a music department, participants may feel more comfortable with this type of active rehearsal rather than attempting to sing through the entire song. This could also better highlight the salient information for the students allowing them to focus more on the word lists and definitions and less on the extra lyrics.

The research involving the use of mnemonic-like songs also appears to contradict the findings of this study. This research found that when pairing information with music as lyrics, significantly aided participants in the recall of information (Calvert & Tart, 1993; Rainey & Larson, 2002; Wallace, 1994). The difference in these studies was that the participants actively sang the mnemonic rather than passively listening to it, as is the case in the present study. Active rehearsal of the mnemonic may have altered the results of the current study.

In future research, professors could also allow the students to listen to the song multiple times in order for repetition to help with the memorization of the information. Professors could also go into the class knowing the song themselves. They could then facilitate the active rehearsal and learning of the song which, as per the results of several studies explored above (Baddeley, 1983, 2002; Baddeley & Hitch, 1974; Jeung et al., 1997; Mousavi et al., 1995;

Ormrod, 2012; Penney, 1989; Tindall-Ford et al., 1997), is likely to help in the memorization of the material and aid in student recall. The current research results indicated that the use of a mnemonic-like song did not significantly aid students in recalling information after a two-week delay in presentation and recall task. This finding would appear to support the previous research indicating that participants' abilities to recall information may decline over time (Tillmann & Dowling, 2007; Waugh & Norman, 1965) or when added information is presented between the initial presentation of information and the need to recall that information (Waugh & Norman, 1965). It is possible that the delay of two weeks from the presentation of the material to the recall task included enough information from their business class and the other classes they were taking so that they were unable to remember the information.

This study indicated that the use of a mnemonic-like pop song potentially hindered delayed recall of information if the information was presented a single time. The research dealing with advertising and marketing indicates that the unconscious listening to commercial jingles with important information such as phone numbers aids consumers in the recall of information (Alexomanolaki et al., 2010; Pham & Vanhuele, 1997; Shapiro & Shanker, 2001; Yalch, 1991). This, paired with the previously discussed cognitive load theory research findings and the findings from research using short mnemonic songs for information recall (Calvert & Tart, 1993; Rainey & Larsen, 2002; Wallace, 1994), would seem to contradict the findings from the current research. However, there are slightly nuanced differences between these studies and the present study that could explain the differences in results.

The current study only presented the mnemonic song to the participants three times over a week's time. The advertising and marketing studies (Alexomanolaki et al., 2010; Pham & Vanhuele, 1997; Shapiro & Shanker, 2001; Yalch, 1991) presented the commercials or songs to the participants a minimum of five times before asking them to recall the information. While an additional two presentations does not seem like a significant number of times, when one considers that the commercials and jingles used in that research were no more than one minute long, while the mnemonic utilized in the current study was over four minutes long, the difference is apparent. Not to mention that participants in the advertising and marketing studies listened to or watched the advertisements multiple times per day while the participants in the current study were only able to listen to the song once a day for three non-consecutive days. This lack of repetition could explain the differences in findings.

The current study included a slightly over four-minute song, while the songs from the previous research involving mnemonic songs (Calvert & Tart, 1993; Rainey & Larsen, 2002; Wallace, 1994) only included songs of approximately 30 seconds. It is possible that the information presented being stretched out over three minutes, even if the subject recognized the original song, was too much information for the participants to handle. The cognitive load may have been too taxed to process the information into long-term memory effectively.

The fact that the six environmental forces were only included in the mnemonic-like pop song a single time could have acted as a distraction to the participants affecting their ability to recall other information. Bach et al. (1992) found that participants had difficulty recalling information when unpleasant music was paired with a list of words they were asked to recall. Balch et al. also found that using distraction information significantly negatively impacted a subject’s ability to recall information.

It appears that the single presentation of the six environmental forces in the current study acted as a distractor for the four Ps. Thus, in the second recall task, participants who listened to the mnemonic-like song were significantly worse at recalling any of the information than those participants who did not listen to the music and had no distracting information presented. This is evidenced in the fact that the treatment group was presented with the four Ps multiple times throughout the mnemonic and yet the results of the doubly-multivariate analysis of variance indicated no significant difference between scores of the treatment or control groups with regard to the four Ps. However, the treatment group was presented with the six Fs only once and their scores on the six Fs were significantly worse than the scores from the control group over the same information.

The difference in the four Ps and six Fs scores may also be explained by the difference in answer types when paired with the mnemonic behaving as a distractor. The four Ps question required participants to include both a list of terms and a definition of those terms. However, the six Fs question only asked for participants to include a list of terms. The mnemonic device, with its repetition of the four Ps information, may have caused participants in the treatment group to focus more on this information. The treatment group may have been subliminally guided into thinking that this information was more important due to its repetition. Thus, they would have put more effort into committing the four Ps and their definitions into long-term memory than they would have in committing the six Fs to long-term memory. This would transform part of the mnemonic into a distraction rather than a helpful rehearsal of information. In summary, while the intent of this research was to examine if there was a significant difference in a subject’s ability to recall information when it is presented in either a single or repeated exposure to the musical mnemonic, it is not clear that this study answered that question.

The current study found that participants' musical experience did not significantly affect their ability to recall information. This finding agrees with the findings from Wallace’s (1994) research on information recall with spoken versus sung word lists. This finding may also correlate with the cognitive load theory. Students with musical experience may be trying to analyze more parts of the music itself rather than focusing entirely on the words and information presented in the mnemonic song. If they were focusing on the music rather than the words, this could have taxed their cognitive load hindering their ability to recall the information.

Implications for Theory and Research

Chapter 2 included a theoretical framework for the current study based on the intuitive hypothesis that the addition of melody to text will help facilitate the recall of concepts better than merely reading the text. The framework included a guiding expectation from previous work involving studies using short melodies and random word lists or lyrical recall. Unlike the previous studies, this study aimed to examine if pairing concepts and their meanings with musical stimuli can aid recall. Participants were asked not to merely recall terms but also pair the correct information concerning that term with the appropriate term, similar to what Yalch (1991) did. Findings of this research indicated that this did not aid in recall. This study examined if the addition of the understanding of concepts to the verbatim recall of concepts can be aided through musical stimulus or if the cognitive load (Paas et al., 2003; Sweller, 1988) is overburdened due to the amount of information presented to each participant. The findings of this study indicated a possibility that the cognitive load capacity was taxed, thus negating potential positive effects of the mnemonic-like song.

Implications For Teaching Practice

Today's teachers are constantly trying to find new and innovative ways to present information to their students. This is all the better if that presentation of information is effective in helping the students to recall that information at a later time. While songs have been used in the past for helping to remember information such as that used in the Animaniacs cartoon (Mills

& Fleischer, 1993) that was for remembering the 50 states and their capitals, it appears that the information presented in these songs needs to be presented in specific ways.

Results from the current study indicated that if a teacher would like to use a mnemonic-like song in order to aid their students' ability to recall information, the information may need to be presented an equal number of times in the song, presented multiple times in one day and multiple times over time, potentially no more than around one minute in length, and actively rehearsed. Suppose the information is presented in unequal amounts. In that case, it appears that the lesser presented information may act as a distractor piece and hinder students' abilities to recall any of the information, much less certain parts. As with the results of the marketing and advertising studies (Alexomanolaki et al., 2010; Pham & Vanhuele, 1997; Shapiro & Shanker, 2001; Yalch, 1991), it appears that the songs need to be no more than approximately one minute in length. This may help with both eliminating distracting information and with helping not to overload the cognitive memory capacity. This would also allow the information to have a better chance of being processed into short-term and long-term memory regardless if the information is actively rehearsedt.

Previous research (Balch et al., 1992; Smith, 1985) also indicates that preference for the musical mnemonic device may play an important role. These studies have indicated that if the participants enjoy the music that is paired with the information, they are more likely to be able to recall more of that information. Teachers may turn this mnemonic creation around for implementation in the classroom. Perhaps having the students choose their own songs and then having them create their own mnemonic devices and parodies could help with the later recall of that information.

Finally, it appears that, for best results, the mnemonic-like songs also need to be actively rehearsed by the students. Previous research (Calvert & Tart, 1993; Rainey & Larsen, 2002; Wallace, 1994) indicates that this is a more effective way of encoding the information into working memory than unconsciously listening to the information or the mnemonic-like songs. Participants need to have the words available to them and should be guided through a rehearsal of the mnemonic.

Recommendations for Future Research

The methodology used for this study was employed because it was the most feasible and least intrusive for the teachers involved in the research. Different results may have been found if the mnemonic-like song had been able to be presented more often, the recall tasks could have been inclusive to only the information presented in the mnemonic-like song, and a rehearsal technique could have been employed for teaching the students the mnemonic-like song.

The mnemonic-like song needs to be presented more often, both daily and over time. If the students had had a way to listen to the mnemonic-like device outside of the classroom setting, that would have been ideal. However, there would need to be a way of tracking the usage of the song and a way to ensure that each of the students listened to the song the same number of times each day. This would help ensure that the participants are exposed to the stimulus and information the same number of times. This would also more closely replicate the way that commercials and jingles are utilized and could potentially garner results closer to previous marketing and advertising studies (Alexomanolaki et al., 2010; Pham & Vanhuele, 1997; Shapiro & Shanker, 2001; Yalch, 1991).

Students also need to employ a rehearsal technique to the mnemonic-like song. This could include chanting the lyrics to the song in the same rhythm as the song or learning the song to the point of being able to sing and perform with the song. Students might also benefit from having the lyrics to the mnemonic-like song presented to them in written form via a handout or PowerPoint slide. This would allow for them to be able to use rehearsal techniques or even allow the teacher to utilize guided practice strategies to help better learn the song, and, thus, the students would have a better chance of encoding the information from the mnemonic-like song into long-term memory.

The familiarity of the song could have been a possible distracting factor in the results of the current study. The overwhelming majority (n = 42) of the treatment participants (n = 45) indicated that they recognized the original song. The song was chosen for its believed familiarity with the participants of the current study. However, the cognitive discord between the lyrics from the original song and the new lyrics may have led to a problem with extraneous cognitive load (NSW Department of Education, 2017). The participants may have had issues with separating the original lyrics from the new lyrics and the song when used as a mnemonic device, acted more like a distraction than a help. Music preference may have also been a factor here. While the participants were not asked if they liked the song or not, previous research (Balch et al., 1992) indicated that subjects are able to recall more information when the information is paired with music which they preferred rather than music that is unpleasant to them.

The list of terms and their definitions may have also become too embedded in the lyrics and the complexities of the song to have a positive impact on student recall. When added to the familiarity issue, the terms and their definitions were not clearly stated in list fashion (i.e., the four Ps are . . .). Again, this may have negatively affected the participants' ability to extract the important information from the song, and, thus, was another factor that turned the mnemonic song into a distraction rather than a help.

In an ideal study, the recall task would only include those items that were presented in the mnemonic-like song. Unfortunately, the current study utilized additional questions as the cooperating professors requested. However, the ideal research would only include information from the mnemonic in order to help to ensure that there are no distracting pieces that could skew the results one way or the other. The side-effect of including the extra information in the quiz given to the students may have been confusing as to what were the important points of the quiz. Since students knew that this extra information would also be covered on the quiz, they may have focused more on those aspects than the information presented in the mnemonic-like song.

Conclusion

Songs used as mnemonic-like songs have the potential to aid students' ability to recall information both in the short term and long term. However, the research would support that songs need to meet certain conditions in order to ensure that the cognitive load is not overtaxed and that students have the opportunity to rehearse these songs actively. If these conditions are not met, it is very likely that the mnemonic-like song will not aid students in their ability to recall information, and it may hinder this ability, especially over time. While the results of this study indicated that this longer mnemonic-like pop song did not significantly help in the recall of information, either in the short-term or in the long-term, the previous research paired with the potential future studies appears to be promising in garnering different results and thus providing teachers with a better way to teach students. Future research should include ways to incorporate active rehearsal techniques or guided practice of the song and their key concepts.

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APPENDIX A: THE FOUR PS: A MARKETING MIX (THAT'S WHAT I LIKE PARODY)

Verse 1

I gotta a product that needs sellin: Gotta make my money: Products more than this thing: gotta include the warranty: package it all up: pack package it all up: find out if it's what they want: if if it's what they want:

Verse 2

Price is the next big P: Gotta go make that green: if it's too expensive: Julio ain't gon' buy it: you gotta price it right: got got to price it right: said you gotta hit the market: take my wallet man I want it

Bridge

Jump in the Cadillac, girl let's put some miles on it: Placement is the next P: gotta get it to the stores: should we go to Walmart: should we go to big lots: we gotta think of it all

Chorus

Price is how much we gonna charge: Placements' where we sellin it at: Lucky for you that's the four Ps: a marketing mix: Lucky for you that's the four Ps: a marketing mix: Products the thing that we got: Promotions letting 'em know: Lucky for you that's the four Ps: a marketing mix: Lucky for you that's the four Ps: a marketing mix

Verse 3

Should we do trips to Puerto Rico: Facebook maybe radio: This is the promotion: girl, it takes a lotta, communication: can't never forget to reach out to the masses: I promise the four Ps: ain't gon' never leave

Verse 4

Shopping sprees in Paris: Made an A on this test: take a look in that mirror: now tell me 'bout them four Ps: Is it product (is it price): is placement (is it promotion): The four Ps (the four Ps): and I'll agree, baby

Bridge

Jump in the Cadillac, girl let's put some miles on it: Placement is the next P: gotta get it to the stores: should we go to Walmart: should we go to big lots: we gotta think of it all

Chorus

Price is how much we gonna charge: Placements' where we sellin it at: Lucky for you that's the four Ps: a marketing mix: Lucky for you that's the four Ps: a marketing mix: Products the thing that we got: Promotions letting 'em know: Lucky for you that's the four Ps: a marketing mix: Lucky for you that's the four Ps: a marketing mix

Verse 5

Think of environmental analysis: Competitive baby: Technological baby: Sociological, economical, political, and legal too: If you think of these: Girl and they change: The four Ps change too: Tell me baby: tell me tell me baby: what were those four Ps

Chorus

Price is how much we gonna charge: Placements' where we sellin it at: Lucky for you that's the four Ps: a marketing mix: Lucky for you that's the four Ps: a marketing mix: Products the thing that we got: Promotions letting ‘em know: Lucky for you that’s the four Ps: a marketing mix: Lucky for you that’s the four Ps: a marketing mix

APPENDIX B: SPOKEN SCRIPTS PRECEEDING SONG

Day 1

In just a moment, you will be presented with a parody song. Right now, you should have been handed a consent to participate in research form. Please look over the form and complete the final page should you choose to participate in this study. (Pause for 3 minutes).

Should you choose to not participate in the study, you will be able to indicate this on the quiz and your results will not be included in the study. Once you have completed the final page, please pass those forms to your right and my research assistant will collected them. (Pause for 1 minute).

Please listen to the song and do your best to not have any other distractions. You will be tested over this material. Tonight, please read chapter 11 in your texts.

Day 2

In just a moment, you will be presented with a parody song. Please listen to the song and do your best not to have any other distractions. You will be tested over this material at the next class meeting.

Day 3

In just a moment, you will be presented with a parody song. Please listen to the song and do your best not to have any other distractions. You will be tested over this material following the song.

APPENDIX C: INTRODUCTION TO RESEARCH SCRIPT

You are asked to participate in a research study conducted by John Williams (Larry Tinnerman, faculty sponsor), from the Bayh College of Education at Indiana State University. This study is being conducted as part of a dissertation. Your participation in this study is entirely voluntary. You have been asked to participate in this study because you are a student in a BUS 100 course during the Fall 2018 semester at Indiana State University.

The purpose of this study is to examine the effects of musical mnemonic devices in the aid of short-term and long-term memory recall. This study is designed to inform the teaching profession on the potential benefits of using mnemonic devices in their teaching strategies.

There are no reasonably known risks associated with participation in this study. You will not receive any compensation of any form. You may benefit from this research by using new methods of memory storage.

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of implementing the following:

All exams will be kept in a lockable briefcase. Upon the completion of the study, the exams will be kept in a locked filing cabinet for a period of three years. After three years, the exams will be shredded. You will be assigned a research number following the second exam with the names on the cover sheets being destroyed.

You can choose whether or not to be in this study. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind or loss of benefits to which you are otherwise entitled. You may also refuse to answer any questions you do not want to answer. There is no penalty if you withdraw from the study and you will not lose any benefits to which you are otherwise entitled. To withdraw from the study, you must email John Williams (jwilliams95@sycamores.indstate.edu) prior to the second test.

You will now be given an informed consent to review. These will be given out again at the first test for your signature.

If you have any questions about your rights as a research subject, you may contact the Indiana State University Institutional Review Board (IRB) by mail at Indiana State University, Office of Sponsored Programs, Terre Haute, IN 47809, by phone at (812) 237-3088, or e-mail the IRB at irb@indstate.edu. You will be given the opportunity to discuss any questions about your rights as a research subject with a member of the IRB. The IRB is an independent committee composed of members of the University community, as well as lay members of the community not connected with ISU. The IRB has reviewed and approved this study.

If you have any further questions please feel free to ask now or to email them to me at jwilliams95@sycamores.indstate.edu.

APPENDIX D: TEST FOR STUDY

COVER SHEET

NAME:

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*Are you participating in the dissertation research study? (Circle one): YesNo

*Failure to indicate yes or no will indicate that you are participating in the study and your results will be included. If you indicate “no,” your test will be removed from the study and the study researcher will never receive your test.

NON GRADED QUESTIONS

1. Male _________ Female __________ Prefer not to answer ___________

2. Age ___________

3. White/Caucasian _____ Black/African-American _____

Hispanic/Latino _____ Asian _____

Native Hawaiian/Other Pacific Islander _____

American Indian/Alaska Native _____

4. Years of experience playing a musical instrument ___________

5. Have you ever taken a music class (band, orchestra, choir, guitar) in high school or college? Yes ____________No _________

GRADED QUESTIONS

6. What are the 4 Ps of marketing?

a. ______________________

i. Describe this term: ____

b. ______________________

i. Describe this term: ____

c. ______________________

i. Describe this term: ____

d. ______________________

i. Describe this term: ____

7. What is another term that can be used in place of using “The 4 Ps”? In other words, “The 4 Ps” are also referred to as The ________________________.

8. List the 6 Environmental Forces.

a. ______________________

b. ______________________

c. ______________________

d. ______________________

e. ______________________

f. ______________________

9. When any of the environmental forces change, what must also change?

NON GRADED QUESTIONS

10. While answering questions 5-8, did you use any mnemonic device in recalling the information necessary for the answers? For example, did you utilize an acronym (i.e. ROYGBIV for the colors of the rainbow), song (i.e. the ABCs sung to Twinkle Twinkle Little Star), or any other strategy for answering the questions? If so, please describe what you used.

APPENDIX E: INFORMED CONSENT CONTROL GROUP

Informed Consent to Participate in Research

Indiana State University

THE USE OF MUSICAL MNEMONIC DEVICES IN THE AID OF SHORT-TERM AND LONG-TERM MEMORY RECALL

You are being invited to participate in a research study. This study aims to find out effects of musical mnemonic devices in the aid of short-term and long-term memory recall. This study is designed to inform the teaching profession on the potential benefits of using mnemonic devices in their teaching strategies. This document will help you decide if you want to participate in this research by providing you information about the study and what you are asked to do. For this study, you will be asked to take a quiz normally assigned in your class and answer some demographic questions.

Some reasons you might want to participate in this research are to help inform faculty of the potential benefits of using mnemonic devices in their teaching strategies. This could help the teaching profession develop new strategies for helping students to better retain information. You might not want to participate in this research because you will not receive any compensation for your participation.

This study asks you to do the following things: Class 1: Your professor will assign the chapter in the textbook covering the targeted material. Class 2: Your professor will present a normal lecture over the targeted material. Class 3: The test will be administered by the principal investigator (John Williams). The test is a normal part of the BUS 100 curriculum. The test will have the informed consent form as the cover page. The research assistant (Sara Williams) will then collect the tests and place them into the locked briefcase. The research assistant will then assign each student a number. The tests only, not the informed consent nor the demographic questions pertaining only to this research, will be photocopied and names of students transferred to the copies. These will then be given to your professor for grading purposes. The original tests will then be assigned a number according to the student taking the test. These will be placed into the briefcase and given to the principal investigator. The informed consent forms, containing identifying information, will be kept by the research assistant in a locked filing cabinet. This will ensure that the cooperating professors have no knowledge of who participated in the study and it will also ensure that the primary investigator cannot link a test to a student name. The research assistant will retain a password protected Excel document containing the matching student and number information. This document will not be available to either the principal investigator or your professor. Class 4 (two weeks later): The principal investigator will administer the test a second time. The research assistant will again collect the tests and place them into the briefcase. The research assistant will then assign numbers to each test in accordance to the previously mentioned spreadsheet. All coversheets for this version of the test will be destroyed. The research assistant will then place the tests into the locked briefcase and give them to the principal investigator. Your professor will not have access to these tests. Any tests not qualifying from the original administration will be destroyed. Those who choose to opt out of the study will still be presented with the same procedures and testing. However, your materials will not be used for the study.

You have been asked to participate in this research because you are a student in a BUS 100 course during the Fall 2019 semester at Indiana State University.

The choice to participate or not is yours; participation is entirely voluntary. You can decline to have your quiz included in the research or withdraw at any time. If you decide not to participate, to decline some activities, or withdraw, you will not lose any benefits which you may otherwise be entitled to receive. You may also refuse to answer any questions you do not want to answer. There is no penalty if you withdraw from the study and you will not lose any benefits to which you are otherwise entitled. To withdraw from the study, you must email John Williams (jwilliams95@sycamores.indstate.edu) prior to one week after the second test.

Every effort will be made to protect your confidentiality by means of implementing the following: The original tests will be assigned a number according to the student taking the test. These will be placed into a locked briefcase and given to the principal investigator. The informed consent forms, containing identifying information, will be kept by the research assistant in a locked filing cabinet. This will ensure that your professor has no knowledge of who participated in the study and it will also ensure that the principal investigator cannot link a test to a student name. The research assistant will retain a password protected Excel document containing the matching student and number information. This document will not be available to either the principal investigator or your professor. For the second administration of the test, the research assistant will again collect the tests and place them into the briefcase. The research assistant will then assign numbers to each test in accordance to the previously mentioned spreadsheet. All coversheets for this version of the test will be destroyed. The research assistant will then place the tests into the locked briefcase and give them to the principal investigator. Your professor will not have access to these tests. Any tests not qualifying from the original administration will be destroyed.

There are no reasonably known risks associated with participation in this study. You will not receive any compensation of any form.

This study will help to inform the teaching community as to the potential benefits of using mnemonic devices.

If you have any questions, please contact:

Principal Investigator: John Jennings Williams

Phone: (812) 462-4320

Address: 425 S. 24th Street, Terre Haute, IN 47803

Email: jwilliams95@sycamores.indstate.edu

Research Assistant: Sara Williams

Phone: (812) 237-2285

Address: Indiana State University, Scott College of Business, Terre Haute, IN, 47809

Email: Sara.Williams@indstate.edu

Faculty Sponsor: Larry Tinnerman

Phone: (812) 237-2957

Address: Indiana State University, University Hall 314A, Terre Haute, IN 47809

Email: Larry.Tinnerman@indstate.edu

If you have any questions about your rights as a research subject or if you feel you have been placed at risk, you may contact the Indiana State University Institutional Review Board (IRB) by mail at Indiana State University, Office of Sponsored Programs, Terre Haute, IN 47809, by phone at (812) 237-3088 or by email at irb@indstate.edu.

I understand the procedures described above. My questions have been answered to my satisfaction, and I agree to participate in this study. I have been given a copy of this form.

PRINTED NAME: ____

SIGNATURE: ____

Date:____

APPENDIX F: INFORMED CONSENT TREATMENT GROUP

Informed Consent to Participate in Research Template

Indiana State University

THE USE OF MUSICAL MNEMONIC DEVICES IN THE AID OF SHORT-TERM AND LONG-TERM MEMORY RECALL

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This study asks you to do the following things: Class 1: Your professor will assign the chapter in the text book covering the targeted material. You will listen to a song. Class 2: Your professor will present their normal lecture over the targeted material. You will listen to a song.

Class 3: You will listen to a song and the test will be administered by the principal investigator (John Williams). The test is a normal part of the BUS 100 curriculum. The test will have the informed consent form as the cover page. The research assistant (Sara Williams) will then collect the tests and place them into the locked briefcase. The research assistant will then assign each student a number. The tests only, not the informed consent nor the demographic questions pertaining only to this research, will be photocopied and names of students transferred to the copies. These will then be given to your professor for grading purposes. The original tests will then be assigned a number according to the student taking the test. These will be placed into the briefcase and given to the principal investigator. The informed consent forms, containing identifying information, will be kept by the research assistant in a locked filing cabinet. This will ensure that the cooperating professors have no knowledge of who participated in the study and it will also ensure that the primary investigator cannot link a test to a student name. The research assistant will retain a password protected Excel document containing the matching student and number information. This document will not be available to either the principal investigator or your professor. Class 4 (two weeks later): The principal investigator will administer the test a second time. The research assistant will again collect the tests and place them into the briefcase. The research assistant will then assign numbers to each test in accordance to the previously mentioned spreadsheet. All coversheets for this version of the test will be destroyed. The research assistant will then place the tests into the locked briefcase and give them to the principal investigator. Your professor will not have access to these tests. Any tests not qualifying from the original administration will be destroyed. Those who choose to opt out of the study will still be presented with the same procedures and testing. However, your materials will not be used for the study.

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This research may benefit you directly by using new methods of memory storage. This study will help to inform the teaching community as to the potential benefits of using mnemonic devices.

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I understand the procedures described above. My questions have been answered to my satisfaction, and I agree to participate in this study. I have been given a copy of this form.

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