

**USING NEUROCOGNITIVE THEORY TO DEVELOP
A NEW APPROACH FOR TEACHING GERMAN GRAMMAR**

THE EFFECT OF COLOR-CODING GERMAN GRAMMAR ON LANGUAGE
ACQUISITION

By

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ABSTRACT

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The objective of this research project is to find out whether or not color coding has an effect on second language learning, in particular on learning German grammatical features, by using neurocognitive theory to develop a new approach for teaching German grammar. The experiment was conducted in two separate environments, one in a natural setting of a regular beginner's German class in the German Department (66 subjects), Experiment I; and the other one in a controlled laboratory setting in the Psychology department (82 subjects), Experiment II, both of the University of Kansas. The main goal of this study is to compare the control group (black and white grammatical features in black boxes) with the experimental group (color-coded grammatical features in black boxes), and isolate the effects of color on the acquisition of L2 grammar. The grammatical features tested were the articles and nouns in the nominative, accusative and dative cases as well as articles and nouns in context with accusative and dative prepositions. These grammatical categories were also tested across time. In the setting of the German class, memory was tested on the day of the first exposure, after one day (which was a repeat exposure), after one week and finally after four weeks. In the laboratory setting of the Psychology Department, memory was tested only after one day. Also the

application of words in isolation (non-contextualized) and of words embedded in context of full sentences was tested.

The results of the experiment across groups (color vs. non-color), across the different grammatical cases, across times of exposure, and across gender of the nouns were calculated according to the percentages of the correct answers given. An analysis of variance statistical analysis (ANOVA) was run for the dependent variable across all five independent variables. When reporting a statistically significant difference, it is understood that this mean difference reflects a p value of .05, which means a 95% confidence interval was used for the analyses.

The overall results of the collected data reveal a statistical significant advantage of color over black and white instructional material, with a 16% overall superior performance by the experimental group over the control group in Experiment I, and with 13% overall better performance by the experimental group over the control group in Experiment II. Memory was enhanced significantly by color coding German grammatical features. Even after four weeks of exposure, the experimental group (color) performed better than the control group (black and white) on the first day of exposure.

In conclusion, the data of this experiment suggest that color enhancement can make a statistically significant difference in learning and remembering German grammatical material. The overall results of this research study give reason to propose that color enhancement of particular linguistic features can be considered a promising tool for better learning and retention of German grammar. These findings are not limited to German grammar learning alone; they could be adjusted and applied to foreign language learning in general, supported by the use of neurocognitive theory in developing a new approach for teaching foreign languages.

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I wish to express my sincere gratitude to Dr. William Keel, Chairperson of the German Department of the University of Kansas, for agreeing to be my advisor. I thank him for his support and encouragement to embark on my doctoral dissertation which bridges the disciplines of German Linguistics and Neurocognitive Psychology.

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Finally, I would like to acknowledge Gordon T. Beaham III., a leader in the Kansas City business community, who was instrumental in my initial involvement with the Lozanov teaching method. I thank him for his enthusiasm and support in pursuing the study and, consequently, the teaching of the Lozanov method at my language center *Languages on Wings*.

Last, but not least, I am grateful to my daughter Kristina Kohler for her professional suggestions and proofreading my dissertation. I thank her for her interest, her patience and valuable input.

Dedication

In loving memory of my mother Berta Hildebrandt,
who gave me the foundation for a lifelong quest toward new horizons.

Through all my years of study,
my daughters Dr. Ulrike Kohler and Kristina Kohler, MBA, were my inspiration.

I thank them for their encouragement, help and love.

I also dedicate this book to my grandchildren, Rebecca and Derek,
with the wish that they might always find new horizons to investigate.

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Ph.D. Dissertation for Applied Linguistics

Introduction:

Over the last decades, in the field of applied linguistics fundamental changes in philosophy and methodology of teaching foreign languages have emerged. These new approaches in L2 acquisition paradigms are closely connected to and very often based on the tremendous research developments in the field of neuroscience. In certain areas, both disciplines are inter-related and play a crucial role in their mutual search of human brain functions and their mental properties to better understand the learning process of language. Such research in the field of psychology led to new approaches in the field of foreign language teaching, to a trend with popular L2 teaching methodologies which advocate implicit versus explicit L2 grammar teaching and learning. These unorthodox views caused a great debate among linguistic scholars about the role of grammar teaching. This debate sparked my curiosity and I became particularly interested in researching a novel approach to teaching and learning German grammar that utilized and incorporated the stimulus of color in connection with particular grammatical features to increase visual attention and consequently better grammar learning. The goal of my study was to examine the cognitive relationship between color-coding German grammar and the consequent mental process in learning and remembering the presented material. My hypothesis was that the structured input of color-coded grammar may have a positive effect on the learning and acquisition of German grammar.

With this research project, I was building on my previous study of the cognitive relationship between music processing and foreign language learning. The test results of the former experiment (2000) showed a significant effect of classical music, specifically baroque music, on German language acquisition, thereby, suggesting that music can be a significant

influencing factor in the teaching and learning of a foreign language. Consequently, since music and color (art forms) are related fields of stimuli, it seemed plausible to me to want to investigate the possible influence of specially designed color-coded grammar on second language learning and memory, based on new findings in brain research. This would offer an important next evolutionary step in the field of language instruction. I based my previous study of the influence of baroque/classical music on second language acquisition on the Suggestopedia methodology (Lozanov, 1978). While said methodology does not propose color as part of its philosophy, it seemed plausible that the inclusion of color as an aid to enhance language learning would be congruent with the general cognitive constructs suggested by this method. Like music, color could be an appropriate cue to learning and, therefore, by testing its impact, could prove to expand the methodology of Suggestopedia or any other teaching/learning method/approach.

Research on language has spanned several fields of interest and disciplines. In the development of my study, I have consulted research from linguists, sociologists and psychologists. I have concentrated especially on neuroscientific literature of the brain that addresses functions pertinent to language perception, memory and retrieval. An outline of the introduction section is provided below.

First, in Chapter I, to frame the phenomena of language, this introductory section will start with a historical look at language and color. The second chapter presents the nature and characteristics of the physiology for language production, including functional localization of language discussing the nature and characteristics of the physiology supporting language production as well as the nature and characteristics of the neurophysiology of language perception.

With the advent of more sophisticated methods for recording normal, healthy brain function over the last forty years, a greater understanding of language perception and acquisition has been gained.

The third chapter discusses research in second language acquisition that is being conducted by neuroscientists and sociologists as well as linguists, speech pathologists, anthropologists and others. A discussion of such literature is also included.

The issue of second language acquisition is closely related to second language teaching and, thus, the fourth chapter is dedicated to a review of the development of teaching methodologies from the last hundred years to the present.

This experiment focuses on German grammar acquisition. Therefore, chapter five is dedicated to literature reviews of L2 grammar acquisition, on focusing, on noticing and attention as well as awareness of newly presented instructional material. Research in the field of input enhancement is also discussed.

Finally, the main focus of the final section in this introduction will detail my experiments, which examine the effect of color-coded grammar on second language learning and memory, specifically the German articles with nouns in the nominative, accusative and dative cases as well as German articles with nouns in context with accusative and dative prepositions. In addition, to examine the influence of color coding on grammar acquisition, the current research also includes two other empirical manipulations, designed to address important questions in the study of language teaching.

First, much discussion has occurred and suggestions have been made to the effect that vocabulary learning would be more effective when presented in full and comprehensible sentence concepts instead of rows of single words (rote learning) as it was practiced until fairly

recently. This led me to test both approaches: vocabulary presented in isolation, and vocabulary presented in context within full comprehensible sentences. Secondly, I also looked at the possible influence of different learning styles (field independent (FI) and field dependent (FD)) as it applies to foreign language acquisition. Some studies (Moore and Francis, 1991) suggest that FI and FD learners apply different cognitive learning styles. It is believed that FI learners can absorb and organize complex instructional material without losing the ability to precisely identify particular critical information within a large picture. FD learners seem to perform better when they are presented with particular instructional material which makes it easier for them to identify critical information. Research suggests that FI learners perform in visual perception as well as in linguistic tasks better than FD learners. Since color coding creates precisely such markers for better noticing and attention which FD learners should favor, the hypothesis seemed in place that color coded grammatical features would help the FD group in their performance. Therefore, this testing program was included in the experiment.

Through this research, I hoped to gain empirical evidence regarding the influence of color exposure on German grammar for increased absorption, recognition, retention and retrieval of the second language during early second language learning. Finally, in order to provide converging validity, I conducted two versions of this study: the first one in a natural German class room setting, the second one in a controlled laboratory setting in the Psychology Department of the University of Kansas. The data of both experiments give reason to believe that color has a significant influence on the learning process of German grammar features.

The experiment was conducted in full compliance with the rules for human research, as regulated by the University of Kansas Internal Review Board.

CHAPTER I:

A. Historic Viewpoint of Language.

In order to provide some review of human mental and linguistic brain developments over our evolutionary history, this section will try to establish a link between human's early beginnings and present-day brain capacities. Additionally, it might be relevant to see how acutely developed color vision has been for a long time and how well the human brain is equipped in utilizing visual information as a cue for mental processes.

While there is still a fierce debate going on as to the origins of speech, it is currently estimated that speech could have developed as recently as 40,000 years ago or as many as two million years ago (Whitney, 1998). These findings are based on measurements of fossil skulls of Neanderthals who lived in Europe from 85,000 to 35,000 years ago. These fossil records give us clues, from a physiological viewpoint, about the capability of speech of early human (Lieberman, 1991). A vital aspect of human speech ability is its unusual shape of the vocal tract. It is believed to have emerged in *Homo sapiens* about 150,000 to 200,000 years ago (Corballis, 1989; Lieberman, 1984). Whitney (1998) offers a very helpful illustration, giving a clear overview as to the history of human evolution.

The illustration below shows the changes in skull shape and size of several hominid species, demonstrating how the skull becomes larger and rounder on the front and side over time to accommodate a larger human brain, as well as the changes of the oral cavity and voice box to make human speech possible (as explained in the next paragraph).

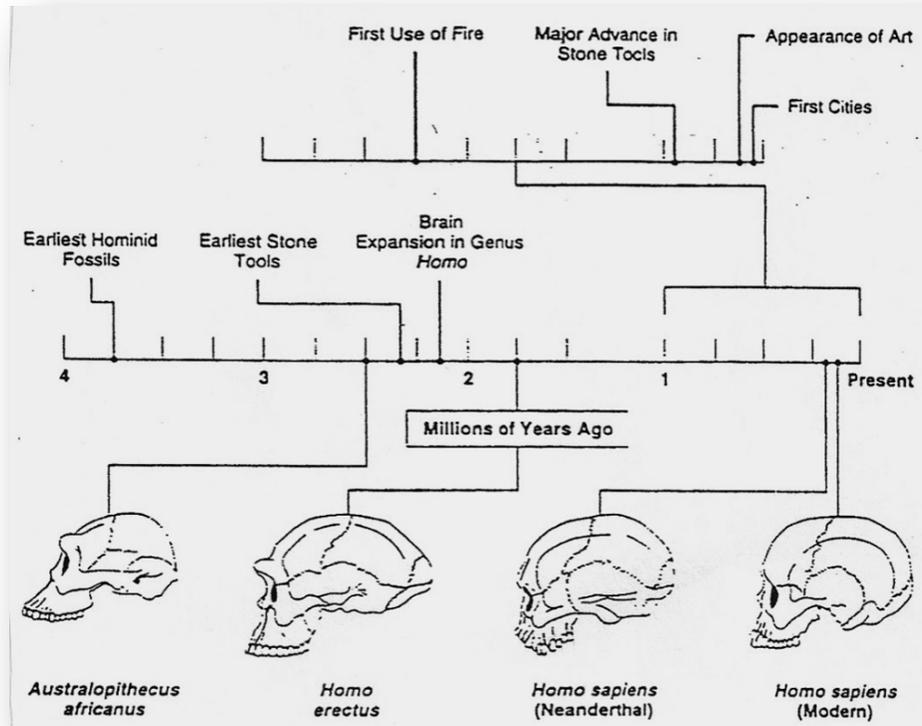


Figure 1: Evolution of the skull and brain, Whitney (1998, p. 5)

This evolutionary perspective gives us an understanding for how relatively new language is in our evolutionary history (Whitney, 1998).

An important researcher in the field of fossil of human evolution, Leakey (1994), states, “there is no question that the evolution of spoken language as we know it was a defining point in human prehistory” (p. 199). Perhaps it is *the* defining point. Equipped with language, humans were able to create new kinds of worlds in nature: the world of introspective consciousness and the world we manufacture and share with others, which we call “culture.” Whitney (1998) emphasizes the aspect that culture is only possible with the use of language. Furthermore, language may even “have revolutionized thought” (p. 4). Today’s linguists and

sociologists find the cradle of their research in those early beginnings when language became a decisive vehicle as communicator and social agent among early human societies.

Not only the change in skull size (with more room for a larger brain) sets humans apart from previous species, but also the physiological change in the actual instrument for producing language. These changes include the voice box and its location. Today the position of the larynx in the throat is lower in the throat than in other species. Over time, the tongue became shorter and rounder and the jaw became shorter. All these changes favor more sophisticated speech. In fact, these physiological changes made it possible for humans to produce language, a highly complex form of communication not used in other primates, either living or extinct (Whitney, 1998). The following illustration by Whitney compares these physiological aspects which are highly developed in humans and make language possible. As can be seen below, this vocal architecture is much less developed in chimpanzees.

Important for speech production is the air passage. The human's physiology with the shorter jaw, the rounder tongue, the lower larynx allow for a sophisticated speech production, as shown below. (The importance of this feature with respect to pronunciation of languages is discussed in this dissertation, Chapter II, A., p. 10).

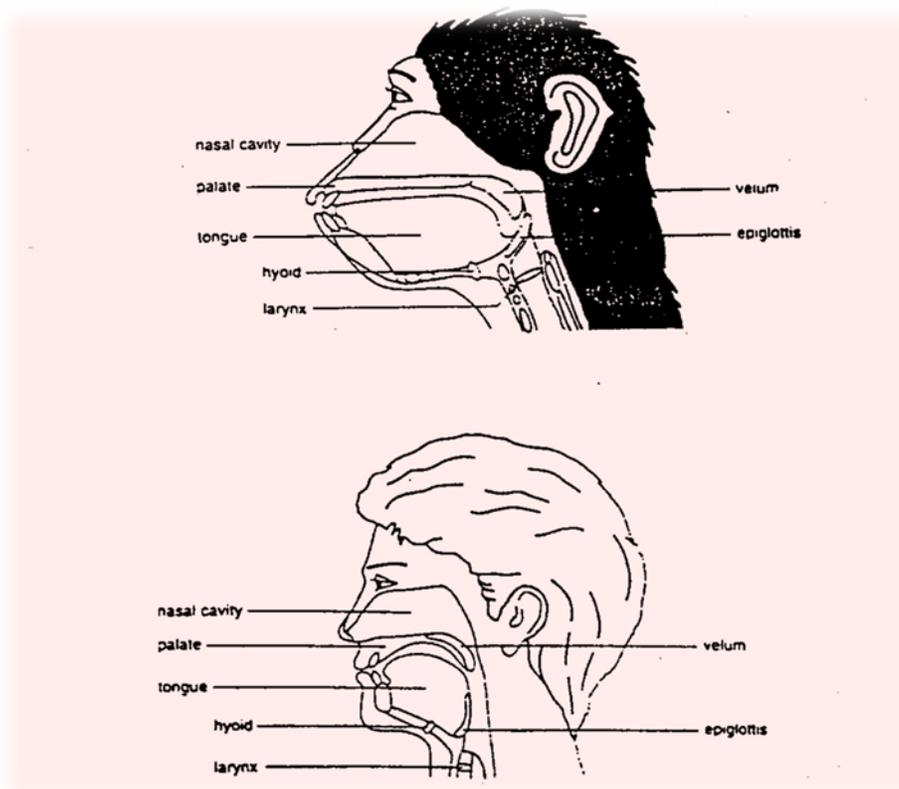


Figure 2: Human and Chimpanzee Vocal Tracts, Whitney, (1998, p. 6).

B. Historical Viewpoint of Color and Color Perception.

To determine the origin of the use of meaningful color representation or application is much harder, because there is no clear fossil evidence that can help us determine when color became a critical functional visual feature used in our perception of the world. In fact, given the fact that color acts as an important survival cue for most mammalian species, there is reason to argue that humans likely used color to navigate and interact with their environment from the earliest point in their evolutionary history. Prehistoric cave paintings as in the Chauvet Cave

(30,000 years old) (Chauvet & Brunel, 1996) and the Cave of Altamira (between 18,000 to 19,000 years old) (Beltran et al., 1999) may give us an idea that form and color played an important role for Paleolithic humans. One can only speculate what functions the beautiful paintings had for those people of long ago; but the discoverers of the caves opened a door into an unexpected museum with sophisticated art depicting herds of animals, bison, huge bears etc. rendered in artful shapes and color. Even in those early days of human existence, color obviously enhanced form and shape and rendered a special mental and emotional image, which to this day is being experienced by cave visitors.

On a more mundane note, the story “Cherries among the Leaves” told by Huddart in 1777 about the color blind shoemaker Harris turns our attention to a very different aspect of color. Huddart says of Harris:

“He observed also that, when young, other children could discern cherries on a tree by some pretended difference of color, though he could only distinguish them from the leaves by their difference of size and shape. He observed also, that by means of this difference of color, they could see the cherries at a greater distance than he could, though he could see other objects at a greater distance as they, that is, where the sight was not assisted by the color. Large objects he could see as well as other persons; and even the smaller ones if they were not enveloped in other things, as in the case of cherries among the leaves” (Huddart, 1777) (p. 10); (Davis, 2000).

This seemingly insignificant account of color versus non-color, leads us to the fundamentally important aspect of color for survival of primates and humans. Color helped in the selection of ripe fruit and vegetables (Davis, 2000), in fact, it was then as it is today an important factor of most aspects of human life. So it is not surprising that vision and color are

an ancient property of the brain, the occipital lobe, which has a rather large and very specialized structure, and as such it is an essential structure in the part of the brain which is most similar to the brain structure of the primate species. Coming back to the questions raised in the current dissertation research, one might argue that color perception could play an important role in detecting specially color-coded grammatical features. Since color perception was well developed from early on in our human existence as an essential tool for survival, for example as cue for edible foods or as a cue for detecting dangerous animals, it seems intriguing to question the effect of this refined mental property for cueing grammatical information. Color might indeed serve as significant mental cue for learning and remembering grammatical features of a foreign language, making the material to be learned more salient for noticing and attending said grammatical features – a very important first stage in the mental process for language learning, retrieval and production (Anderson, 2005). Thus, I would hypothesize that color could be used to great advantage in the language classroom.

CHAPTER II: Physiology of Language and Color.

A. Nature and Characteristics of the Physiology for Language Production.

All languages are supported by the same physiology. The same mechanical systems are used to form their speech sounds, such as vowels and consonants. This is not only interesting for a native speaker, but it becomes extremely helpful for the learner of foreign language. Whitney's (1998) illustrations give an excellent understanding of the vocal apparatus for phonology and speech production.

In Figure 3 below, one can see six points of articulation, i.e. positions in the mouth where the air stream determines specific speech sounds: (1) bilabial, (2) labiodental, (3) interdental, (4) alveolar, (5) palatal, (6) velar positions (Whitney, 1998, p. 38).

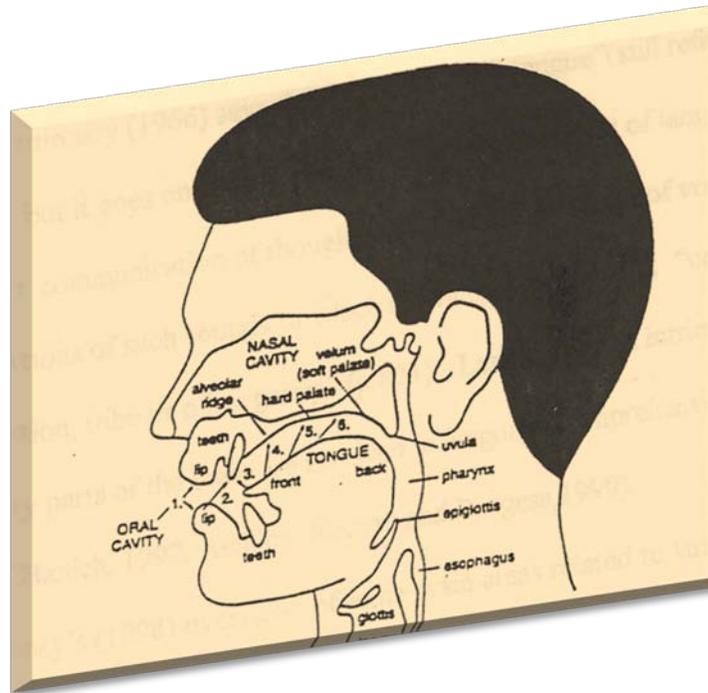


Figure 3: Points of Articulation, Whitney, (1998, p. 38)

This figure is provided in order to illustrate the complexity for the motor manipulation and coordination necessary for speech production. There are many brain regions contributing to this production, as explained in the next section. The understanding of how to “play the language instrument” according to the basic sounds of a particular language (produced by the position of the tongue and the air flow through the throat), could enhance a native-like pronunciation of a second language, which is the goal of many language students. But motoric speech production is only one part of language production.

B. The Functional Localization of Language in the Brain.

Language production is, of course, much more than uttering sounds and combining phonemes (the building blocks of meaningful units), morphemes (the smallest unit of a language with meaning) and ultimately words and sentences (Kellogg, 2003; Hunt & Ellis, 1999). Webster’s dictionary (1966) says that language is a “tongue” (still referring to

physiology), but it goes on to a much more complex definition of language: “the expression or communication of thoughts and feelings by means of vocal sounds, and combinations of such sounds to which meaning is attributed,” and “common to a particular nation, tribe or other group” (p. 821). Language is an intricate mental faculty. Research has shown that language production is a complex system of physiology and mental properties which are coordinating and manipulating the motor function of speech with the diverse regions of the mental faculty of the brain, including cortical structures (SMA, Broca’s Area and Wernicke’s Area) (Carlson, 1998) and sub-cortical structures, thus, many parts of the brain are involved in language comprehension and production (Banich, 1997, Atchley, Keeney & Burgess, 1999).

Whitney’s (1998) overview of some brain areas related to language illustrates the complexity of the functional neuroanatomy of language. Much of the evidence for the involvement of this network of anatomical structures is provided by aphasia patient research (Banich, 1997). An aphasia patient is someone who has a language specific disorder, such as Broca’s aphasia. Recently, the classic functional localization models established with aphasia data have been replicated using functional imaging techniques.

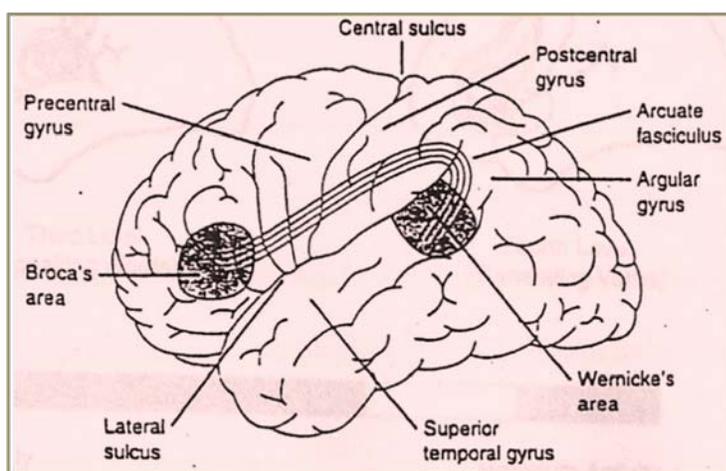


Figure 4: “Lateral Surface of the Left Hemisphere”, specifically Broca’s and Wernicke’s area Whitney, (1998, p. 363).

Matlin (1990) presents the results of PET scan research illustrating four different areas in the brain that contribute to four different language tasks. As is shown here, different aspects of language comprehension and production are localized in different parts of the cortical language network. It is important to note that in both the classic models and in the PET work reviewed here, the focus is on left hemisphere cortical structures.

Though, as stated earlier, some researchers argue that right hemisphere does play some important roles in language, particularly during language comprehension (Atchley, et al., 1998).

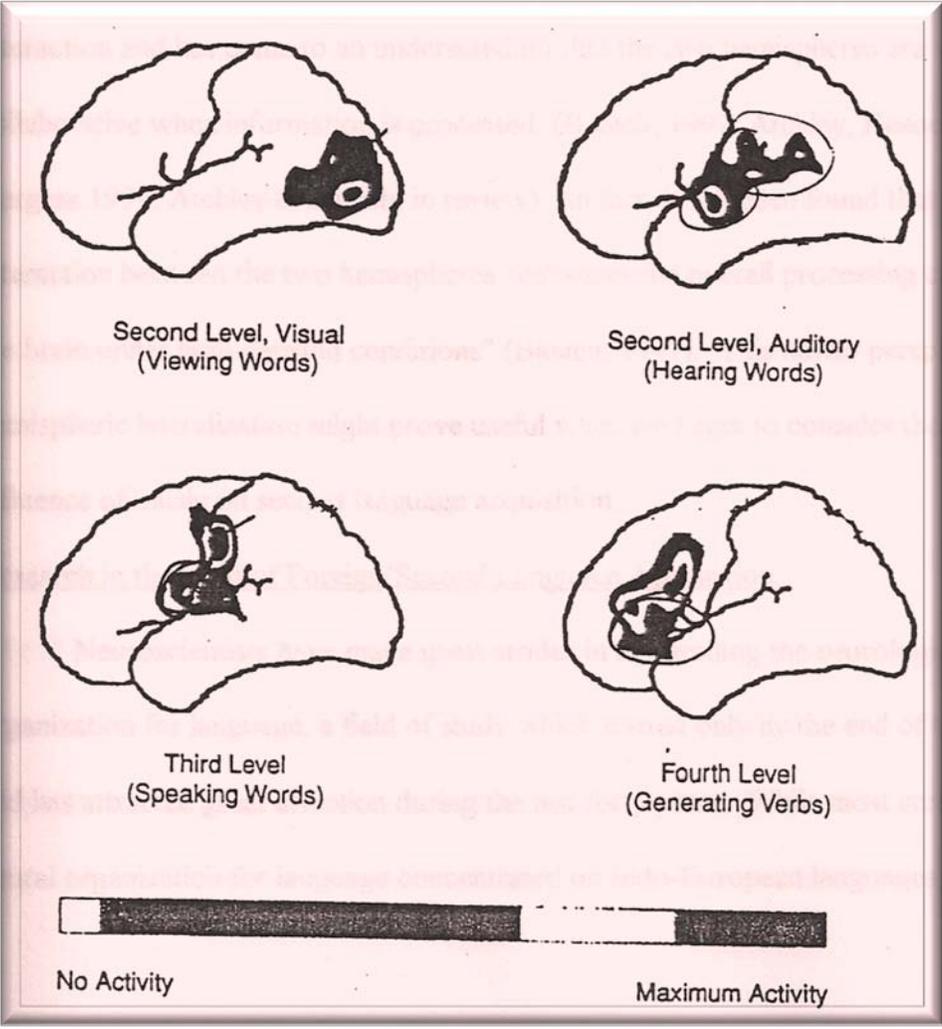


Figure 5: Illustration of the “Results of PET scan research”, Matlin (1990, p. 281)

C. Nature and Characteristics of the Physiology of Color and Color Perception.

As discussed earlier, color is the source of a wealth of information from the world around us with a large radius of effects, as it influences our perceptions and reactions, it enables us to concentrate and select or not select, it gives us clues for memorization, and much more (Mahnke & Mahnke, 1993). It might be warranted to discuss briefly some basic properties of color and color perception. Color originates in light, in sun light. It seems paradoxical that we, i.e. the human eye, perceives sunlight as colorless, yet the rainbow is proof that all colors of the spectrum are present in white light. Color is determined by a spectrum of different wave lengths, and what the human eye perceives as color, is largely a mixture of those wave lengths, partly absorbed and partly reflected from objects (Pinel, 2009). In a very simplistic way, the physiology of color perception might be explained when we imagine looking at a red apple, and the following procedure would happen. As light goes from the source (the sun) to the object (the red apple), and finally to the detector (the eye and the brain); the full spectrum of color (light) hits the red apple. The apple in turn absorbs all the colored light rays, except for those corresponding to red. The red light rays then are reflected to the human eye, which, upon receiving this reflected red light from the apple, sends a corresponding message to the brain (Carlson, 1998). Such is the general timeline of color perception explained in a very simplistic approach.

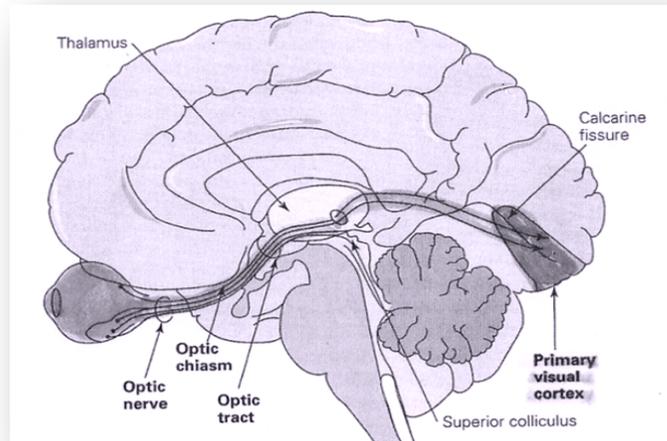


Figure 6: Pathway from visual receptors to the brain (Banich, 1997, p. 32).

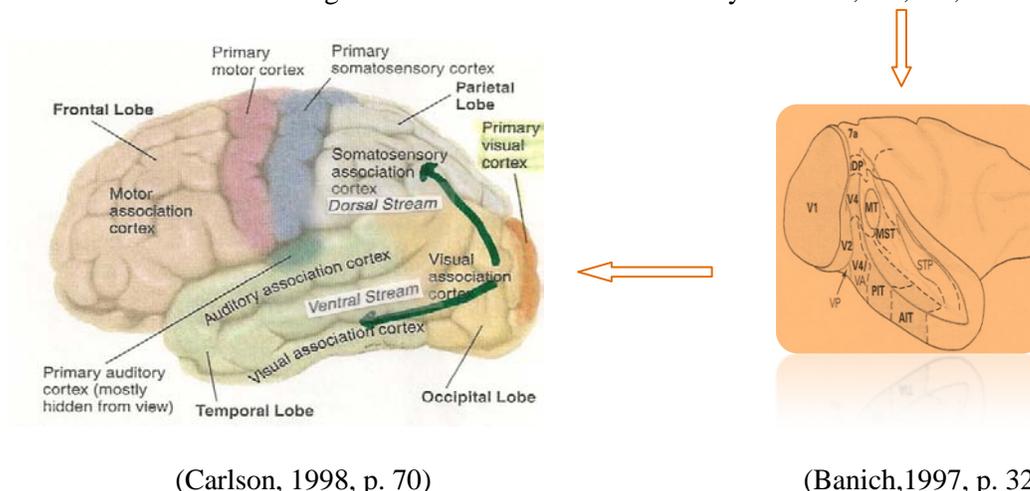
The processing of color in the brain is an intricate and complex process, research about which is being conducted in order to gain more knowledge of the interrelation of color perception, shapes, language, and memory of the different parts of the brain.

In order to better understand how language and color processes might be integrated in the brain, it is helpful to turn to literature on cortical color perception. This will give us a helpful background in better assessing how and why color enhancement for German grammatical features might serve a significant role in the language classroom.

First proposed by Hermann von Helmholtz (1821-94) in the nineteenth century, color vision is based on a cone system consisting of three types of cones, sensitive to wavelengths of red, green, and blue respectively. This view is known as trichromatic color theory. Red, green and blue are considered primary colors; all other colors perceived are combinations/mixture of wavelengths of the primary colors (Peterson, 1991; Mahnke & Mahnke, 1993). More recent clinical studies have shown that there are three broad cortical stages of color processing in the human brain: primary visual cortex, secondary visual cortex and visual association cortex. All these systems have their own functions and collaborate with each other resulting in the

phenomena of vision. It is interesting to note that the first area responding to vision, color, imaging and identification (as well as emotion) is found in the most posterior portion of the brain, in the occipital lobe, in the different vision systems of V1, V2, and V4, which is the primary visual cortex (Zeki & Marini, 1998), as shown in this

Figure 7: Human Brain with vision systems V1, V2, V4,



(Carlson, 1998, p. 70)

(Banich, 1997, p. 32)

Given that color processing occurs very early in visual processing and humans are very effective at color processing, it is reasonable to predict that color-coded stimuli should be very salient to the language students, even when color detection or discrimination is not the intentional focus of the task.

Thus, with respect to this study of color-coding grammar, it is possible that participants might show enhanced language acquisition by heightened attention caused by the presence of color. It is useful to look at research studies of neuroimaging of visual mental imagery. These studies have found that visual mental imagery activates the primary visual cortex (Kosslyn & Thompson, 2003). Imagination is a mental function and it is activated through a mental image representation, causing a visual short term memory (STM) without the visual stimulus, i.e., the stimulus is not really seen by the physical eye. Activation in the brain is caused by “seeing

with the mind's eye" (Kosslyn & Thompson, 2003; Anderson, 2005), which is a function of long-term memory; as shown on the figure below:

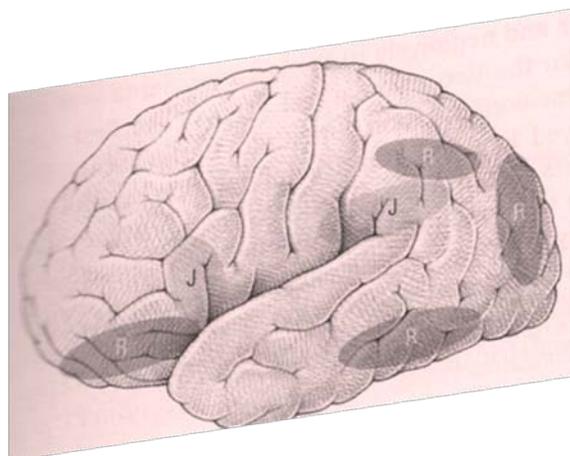


Figure 8: Regions with increased blood flow during mental imagery (Anderson, 2005, p. 107).

These findings are exciting and might give reason to hypothesize that language learners might attend more to color-coded grammar than traditional grammar material for an enhanced intake as well as better memory recall of the color-coded presentation. Also, given that color can be considered part of mental imagery, it seems reasonable to expect that the color-coding might aid in the retrieval process when the students' task is to recall the learned material at later times, without the actual color-coded grammatical features in front of their physical eyes.

Although attention is an important feature of many grammar teaching approaches (like VanPatten's (2003) input processing model; consciousness/awareness raising proposed by Virginia Yip (1994) (as well as the above described scholars in the grammar literature review), including presentation of meaning-based and comprehensible input, it is important to realize that the brain has some inherent limitations to the amount of information it is able to attend to and to process (Banich, 1997). Color might assist in the selective attention process of the brain, which is a cognitive mechanism to help the brain filter vast amounts of incoming information

in order to successfully attend to particular tasks (Banich, 1997). Color might not only stimulate the necessary attention to facilitate intake and recall, but it could possibly help sustain attention for better information processing and language acquisition.

CHAPTER III: Research in the Theoretical Field of Foreign Language Acquisition.

In the field of linguistics and second language acquisition, research has made great strides in studying the neurological organization for language (Chomsky, 1957, Banich, 1997), a field of study that started only by the end of the 19th century and has attracted great attention during the last forty years, (Witkin, Moore, Goodenough & Cox, 1977; Sharwood Smith, 1981; Ellis, 1990; Larsen-Freeman, 1995; Van Patten, 1992; Fotos, 1993; Lightbown & Spada, 1991; Wong, 2004). While most studies of neural organization for language concentrated on Indo-European languages, such as English, it has been found and it is interesting to note that the neurological organization for language seems similar across languages, i.e., despite different linguistic and grammatical rules (Banich, 1997). The neural underpinnings for spoken and written language are similar across the different cultures (Banich, 1997). Research in linguistics (Chomsky, 1957) has suggested the claim that an innate grammar system in the human brain is applicable to all languages, which was termed by Chomsky (1957) as Universal Grammar (UG), and that this is one of the underlying and most fundamental properties of grammar acquisition (Hinkel & Fotos, 2002). However, the majority of this research has focused on uni-lingual individuals. Therefore, we are left wondering about neurophysiology of multi-lingual individuals.

Bi- and tri-lingual individuals are quite common in the world. There are countries in which two and three and even more languages are spoken by the same individuals (e.g. Switzerland, Luxembourg, Belgium, Scotland, Ireland, India, China, etc.). In these

circumstances it is common for a young child to grow up multilingual. From these situations we have learned that early exposure to a second language results in more fluent mastery of that language (Whitney, 1998). This evidence has been taken as support for the critical period for acquisition hypothesis (Lenneberg, 1969). Adults learning a second language after having acquired proficiency in the first language generally do not obtain the same level of second language proficiency (Whitney, 1998). Lenneberg (1967) proposed the critical period hypothesis saying that language acquisition should occur before the onset of puberty in order for language to develop fully. Similarly, this is supported by the maturational state hypothesis (Johnson & Newport, 1989), which argues that language acquisition in early childhood has a superior outcome. This capacity of language acquisition in early life disappears or declines with maturation (Johnson & Newport, 1989). Both findings are based on a general principle that virtually all neural circuits have a window of opportunity for normal development of particular properties (Pinel, 2009), and that in language production it is critical to offer linguistic stimuli at an early age. However, the slow development of the human brain provides opportunities to “fine-tune” and improve previous limitations in language acquisition (Johnson (2001).

Gernsbacher (1994) raises the question whether acquisition of the first language (L1) and the second language (L2) are of a different kind or whether the learning strategies are the same. According to second language research there is a difference in processing strategies as a function of the person’s level of fluency between monolinguals and multilinguals. It is thought that different mechanisms are used in L1 versus L2 acquisition, and these differences are probably due to the establishment of early cue setting in L1 learning at an early age. Early cue setting refers to a pattern of secondary stimulus that influences, mostly unconsciously, language

acquisition at a very early age. Kilborn (1989) points out, though, that these differences in L1 and L2 acquisition may not be entirely due to these kinds of underlying cognitive properties. Kilborn argues that L1 performance is driven by optimality. This means that the L1 learner attempts the very best and most complete language performance. In contrast, the L2 learner reflects more the principle of “economy”. The L2 learner is basically interested in primarily communicating quickly and efficiently even if such performance is not perfect or native-like.

With respect to research on multilingualism, Kilborn (1989) points out that not all of the critical questions in this field have been answered. He argues that psycholinguists as well as linguists concentrate their studies more on the monolingual speakers, mostly English-speaking adults or children, making monolingualism the empirical norm. This limited research scope might pose an inherent scientific risk. Kilborn (1989) recognizes multilingualism as a common, even “universal feature of human behavior” (p. 4) and, consequently, proposes that more attention be paid to cross-linguistic validity for more robust theories in the field of second language acquisition. For the psycholinguistic study of multilingualism, Kilborn (1989) suggests a complex interaction between three related disciplines.

First, the functional linguists, especially typology (the comparative study of different languages) must receive greater emphasis. According to Kilborn (1989), functional linguists offer a reliable database on similarities and differences of fundamental characteristics and structures among the multitude of languages. Secondly, there needs to be more work done in the sociolinguistic discipline. Kilborn (1989) notes that sociolinguists include social and affective factors of cognition and linguists, which make up the complex fabric when cultures and languages mix. Finally, a better understanding of multilingual individuals needs to involve neuropsychology. The neuropsychologists continuously learn more about the brain and how it

processes linguistic information, including research on how two or more languages are represented simultaneously in the brain.

VanPatten (1992) contends that researchers of second-language acquisition are generally theoretical linguists, psychologists, sociologists, or communication specialists who are interested in how languages are acquired. They do not deal with questions as to how to teach the language but rather how languages in general are acquired and organized in the brain. VanPatten presents six major findings from these multiple scientific fields that help us understand how second language acquisition happens. He points out that his review is not an exhaustive account of the research in the field, but rather an indication of what is known about acquiring the grammatical properties of a second language.

Finding 1: Learners of a second language tend to pass through certain transitional stages or sequences in acquiring syntax (sentence structure, including grammar).

It has been fairly well documented that learners of English as a second language generally go through stages of acquisition that are similar to the stages of a native learner. Stages have been identified for syntactic structures such as negation, plural formation, reflexives, etc. Research suggests that there are some universal tendencies in acquiring particular syntactic constructions over time. This evidence is not limited to ESL learners, there is also evidence that learners of the German language go through stages of development (Clahsen, Meisel & Pienemann, 1983) in acquiring verb placement and word order as well as negation (which is quite different from English). Study of these stages is not always easy because developmental stages can overlap, and sometimes learners can go so quickly through the stages, one hardly notices it. Also, some learners can skip stages altogether (Larsen-Freeman & Long, 1991). So, while research evidence supports the idea that developmental

stages influence second language acquisition it is not a simple matter of absolutely predictable developments (VanPatten, 1992). This evidence regarding developmental stages is important because the more similar second language acquisition is to native language acquisition the more we can draw on the native language research in order to understand second language acquisition.

Finding 2: Certain grammatical morphemes (within governing syntactic categories) tend to emerge in a fixed order.

Morphemes and functors (e.g. English *-ing*, Spanish *-aba* and adjective agreement) develop differently from transitional stages of sentence-level syntax. Research suggests that noun-phrase morphemes are acquired over time in a fairly predictable order, verb-phrase morphemes in another, and other morphemes in yet another order. For example, the English *-ing* is generally acquired before the third person *-s* (which is acquired relatively late). Researchers are trying to determine why this is (VanPatten, 1992). These patterns in acquisition may be important because they imply that words and morphemes from different grammatical categories are acquired and processed separately. This appears to imply a separate functional localization for these different grammatical categories.

Finding 3: Language acquisition tends to progress from unmarked to marked elements, defined typologically.

In linguistics, reference is generally made to three word orders: subject-verb-object (SVO), subject-object-verb (SOV) and verb-subject-object (VSO). SOV is the most frequent in the world's languages and is considered less marked. It has been found that language learners acquire the unmarked or less marked forms more easily than the marked forms. Consequently, language learners will produce the unmarked elements first. This applies to both first- and

second-language learners (VanPatten, 1992). Again, this represents an important consistency between first and second language acquisition. Thus, maybe it is the case that the cognitive and neuropsychological structures that perform this parsing function do so for both languages.

Finding 4: Language transfer is not the simple transfer of “habits” as once believed. First-language influence is manifested in one of two ways: psycholinguistic transfer and communicative transfer.

Behaviorists had the simplistic notion of transfer of “first-language habits” (VanPatten, 1992). Researchers have moved away from that belief, and today it is proposed that if and when transfer occurs in the process by which language is internalized, it occurs because of similarities, not differences (VanPatten, 1992). Furthermore, transfer of the first language is believed to be of limited influence. For example, if a learner’s first language has a marked rule but the second language has an unmarked rule, transfer of the first-language rule is blocked. However, if the first language has an unmarked rule, but the second language has a corresponding marked rule, the first-language rule will most likely transfer (VanPatten, 1992). This interesting relationship of transfer might provide clues about how the second language builds on existing linguistic mechanisms.

Finding 5: Not all learner output is rule-governed; some consists of routines and prefabricated pattern.

Researchers have used the terms “routines” and “prefabricated patterns” in their second-language studies. Routines are those expressions that may be undifferentiated and that are stored by the learner as one large lexical item. These are not generated by rules, but rather they are acquired through the same processes that access lexical units. Prefabricated patterns are quasi-rule-governed. The learner stores a particular configuration of speech that has a slot or

blank into which appropriate words or even sentences and phrases may be inserted. It has been found that frequently occurring statements made by the instructor in the second language are the first to be internalized as routines or prefabricated patterns. Research has not yet been able to explain why this occurs (VanPatten, 1992). However, because this pattern of acquisition is specific to acquisition of second language, Van Patten suggests further studies in this area.

Finding 6: For successful acquisition, learners need access to input that is communicatively or meaningfully oriented.

It has been found that learners who hear and see language that they must decode for meaning, advance further and faster in acquiring grammar in comparison to those who are only exposed to mere grammar drills (VanPatten, 1992). Therefore, it is not surprising to learn that the more context rich the language is, the more is acquired. At the same time, one must keep in mind that a learner can only get so much from the input at a given time (VanPatten, 1992). Research on developing stages clearly state that a learner's output does not produce a one-to-one correspondence with input. VanPatten simply wants to indicate that learners who have access to meaningful language from the beginning have a broader base on which to build their internal linguistic system.

VanPatten (1992) indicates that his review of the many aspects of second-language-acquisition research is not exhaustive. There is increasing research in sociolinguistics, pragmatics and variability as well as other aspects of the field which focus on language acquisition as well. However, through this discussion many of the critical similarities and differences between first and second language acquisition are highlighted. Next, let us discuss the related field of second language teaching. The next chapter will address different approaches to teaching foreign languages.

CHAPTER IV: Methodologies of Teaching Foreign/Second Languages.

A discussion of different methodologies for teaching a second language becomes a necessary and important element of the empirical research discussed in this dissertation. In this experiment with color-coded German grammar, I expanded on the teaching techniques of the Suggestopedia method, developed by Lozanov (1971), in combination with the Communicative teaching method. I will discuss these methods in the next section of this dissertation. In order to better understand the possible value and importance of that approach in the field of education, and especially that of teaching and learning grammar, it is necessary to first explore the spectrum of the different approaches and methods of teaching used by educators of foreign languages.

I will review the development of the very early methods of foreign language instruction to the latest methods. A discussion will be provided about how methods and teaching approaches build on one another and how they grow into better tools in the field of second language teaching and learning. These approaches and methodologies have been influenced, to a great extent, by developments and trends in psychology. Psychology has made tremendous strides in brain research, in the study of language acquisition and in memory research. Therefore, educators have turned to psychology for a better understanding and insight into the language learning process (Omaggio, 1986). This review begins with a discussion of the grammar-translation method, which is one of the older foreign language instruction methods.

1. The Grammar-Translation Method.

The grammar-translation method was widely used in the nineteenth and early twentieth centuries, based on psychologists' position that a) the mind was a muscle which needed exercise, and b) that the mind consisted of three major faculties: thinking, feeling, and willing.

These major faculties were then sub-divided into smaller categories such as memory and imagination. It was thought that exercising these faculties would improve the mind. Problem-solving and mental discipline were ideal tools to achieve this goal. Thus, language learning of Greek and Latin was looked upon as stimulating the intellect because it required a vast amount of memorization of intricate rules and paradigms as well as translation exercises of literary texts (Omaggio, 1986, p. 22). This focus on the rules of grammar is central to the grammar-translation method. Early proponents argued that we must focus on the rules of grammar, which are learned deductively by means of long and elaborate explanations. All rules are explained in grammatical terms, including their exceptions and irregularities. Under this method vocabulary is learned from long bilingual lists of words which are taken from a text for a particular class. Comprehension of the learned grammar and vocabulary are generally tested through translation exercises (target language to native language and/or vice versa). The use of a dictionary is encouraged, if not necessary, because of the emphasis on translating from one language to the other. Listening and speaking abilities are not developed in this method. Instead, emphasis on the development of reading and translation is the primary goal of language study. This method requires the instructor to dominate all class activities; students merely follow instructions (Ramirez, 1995).

One potential drawback of this method clearly is the lack of focus on oral communication. The grammar and vocabulary drills might have some benefit for more advanced classes to facilitate proficiency in the written language. However, for the beginner and intermediate level it is both strenuous and boring. This method is no longer popular in many countries. However, students from China in my education class T & L 816 stated that the grammar-translation method is widely used in their country as well as in other Asian countries.

2. The Direct Method.

Another movement that emerged in the nineteenth century, the direct method movement, was mainly promoted by educators such as Berlitz and Jespersen (Omaggio Hadley, 1993).

The basic idea behind this methodology is to imitate the way children learn their native language. For example, words and phrases are directly associated with objects and actions. Similar methods have emerged since the nineteenth-century version, like Lenards's Verbal-Active Method, based on de Sauze (which will not be discussed in this dissertation), the Total Physical Response Method and Terrell's Natural Approach, which will be discussed later.

The Direct Method is also referred to as an "active" method where students are emerged in the new language. Advocators of this method believe that students absorb the new language by listening to it in large quantities. The idea is that students will learn to understand by listening and they will learn to speak by speaking. This is especially the case when listening and speaking activities are accompanied by appropriate actions. For example, pictures and posters are used to facilitate the students' comprehension. In the Direct Method, translation into the native language is strictly avoided. The instructor will compensate with paraphrases in the target language or will use mime to get the meaning of a particular word or action across. Another aspect of this method is its emphasis on the importance of presentation of complete sentences. Also there is a focus on the importance of good pronunciation from the beginning of the learning process. For the most part, grammar rules are expected to be absorbed inductively. When it becomes necessary to explicitly teach grammar, then all discussion is done in the target language (Omaggio Hadley, 1993). Thus, all of these independent components of the directly method support the emphasis on second language learning as an active immersion in the new

language. This method is known as the *Berlitz Method* and is still being taught today in commercial settings.

The Direct Method created a new direction in the field of language teaching as it introduced the viewpoint of implementing a certain methodology in teaching languages, a concept which was not present in previous times (Wong, 2005).

There are some potential drawbacks to this method. While the learning of a new language with this Direct Method is generally exciting and interesting, it may lead to the phenomenon of fossilization, i.e., inaccurate speech, which is resistant to change. In other words, it poses the risk that students who are exposed to unconstrained attempts at communication too early will easily develop inaccurate sentence structure and grammar patterns.

This drawback gradually led to the incorporation of some structured exercises in grammar and short translation as well as occasional use of native-language to clarify new vocabulary or concepts being presented. These newer versions of the Direct Method were called eclecticism (Omaggio, 1986).

3. The Audiolingual Method.

In the beginning of the twentieth century, the faculty doctrine of mental powers (which led to the grammar-translation method) gave way to new psychological schools of thinking about the brain and its learning capacities. Gestalt psychology, psychoanalysis, and behaviorism emerged and, again, influenced the perception of second language acquisition as well as methods of teaching. Especially behaviorism left its mark on education in the first half of the twentieth century. Experimentalists such as Watson and Skinner rejected the notion that psychology was the introspective study of conscious experience. He and other contemporaries (e.g. Pavlov) approached psychology “scientifically” with experiments on small animals like

rats, pigeons, dogs, etc. and they discovered that these animals were learning through “conditioning”. Out of these experiments, the behaviorist school of psychology emerged. According to the behaviorists, all behavior is a response to stimuli, whether the behavior is overt (explicit) or covert (implicit).

The more repeated the stimuli, the more habit forming (conditioning), and consequently, associative learning takes place (Omaggio, 1986). It was this form of behaviorism in the 1940s and 1950s that influenced the next and widely used teaching method of foreign languages.

The Audiolingual Method (ALM) of teaching second languages was developed and used in the military schools, and was ruled by the law of intensity, the law of assimilation and the law of effect which are supported by behaviorist laws (Omaggio, 1986, p.61). The first enthusiasm about this revolutionary method was dampened by the disappointing results in foreign/second language acquisition. Potential drawbacks of this method were felt in the language classrooms because of lack of more diverse stimuli other than just oral. It was felt that some students need to see the words, need the written language, and they need instruction on grammatical rules. The repetitive lessons became monotonous and, thus, they were perceived by students as being meaningless drills. By 1970, the Audiolingual Method had experienced a decline in popularity and many instructors looked for alternative teaching methods to supply their students with better teaching techniques. Today, selected aspects of the ALM are incorporated, within an eclectic framework, in second language classes.

4. The Cognitive Approach.

By 1960, psychology had shifted from the concept of behaviorism, which was an anti-mentalistic, mechanistic view of learning to the cognitive theories of learning. Cognitive theories argue that the mind is actively gaining new knowledge. Therefore, according to the

cognitive perspective, learning must be meaningful and relatable to an individual's cognitive structure (Omaggio, 1986).

Chomsky in his criticism of Skinner's *Verbal Behavior* (1957) argued that S-R psychology could not explain linguistic behavior. Chomsky explained that language production was not merely a mechanical response to a string of memorized environment stimuli. Instead, language is due to a deep processing of meaning and understanding and an active mental participation by the individual. Chomsky's work led to a shift to cognitive psychology, which resulted in new discoveries in organization and cognitive functioning of the mind. According to Chastain (1988), this cognitive approach has influenced educational psychologists like David Ausubel (1968, 1978), who emphasized that learning must be meaningful to be effective and permanent; and it must involve active mental processes and be relatable to existing knowledge the learner already possesses. While the behaviorists stress behavior or changes in behavior as key to the learning process, cognitive psychologists and educators emphasize the role of the mind in processing information. Perception, acquisition, organization, and storage of knowledge are all important activities carried out in the individual's cognitive architecture (Chastain, 1988).

Chomsky also had a direct impact on our understanding of language processing. In his book *Syntactic Structures* (1957) he offered a new theory of linguistics: generative-transformational grammar, a concept that focuses more on syntax rather than on language as sound and meaning. Transformational-generative linguistics proposed a new concept of language. Language was seen as a rule-governed, internal behavior. Chomsky (1965) further theorized that all humans are born with a built-in-language acquisition mechanism called the Language Acquisition Device (LAD) (Omaggio Hadley, 1993).

The cognitive method of foreign language instruction builds on both Chomsky's linguistic theories and on principles of cognitive psychology. The cognitive approach to teaching a second language has as its primary goal to enable the students to gain the same types of abilities that native speakers have. Instructors place minimal control over the rules of the target language. This is done in order to encourage creativity and to encourage the students to generate their own language. One way to foster this creativity is to have students incorporate previously learned material in a meaningful way. It is important that the teacher has a good understanding of building upon known concepts and then adding unknown concepts. The foundation of this method is that understanding and competence must be mastered before performance is requested. According to this method, teaching materials should promote creative use of the language. The goal is to work toward communication in the target language. Emphasis is given to the understanding of the rule system while memorization in rote fashion is avoided. The goal for any learning material is that it should always be meaningful and relatable to students' existing cognitive structure. Again, this emphasis reflects the cognitive perspective that there are significant cognitive differences between language learners. Therefore, when preparing for and delivering a class session, teachers are encouraged to consider all senses and learning styles since individuals have different talents and abilities to acquire new information (Omaggio, 1986).

5. The Community Language Learning (CLL).

The Community Language Learning Method is also called Counseling-Learning. It was developed by Charles Curran (1976) who based his approach on techniques from psychological counseling. He proposed that people have a real need to be understood and supported in the process of reaching for and fulfilling wishes and goals. According to this method, such support

is best achieved with others who strive for the same goals (Omaggio, 1986). This instructional theory, applicable to a wide variety of subjects, assumes that there are parallels between counseling and instructional situation. The learner is the “client,” and the teacher is the “counselor.” The goal is to eliminate insecurity, anxiousness, conflict and frustration for easier learning (Ramirez, 1995, p. 120). The “counselor’s” role is essentially passive. He should merely facilitate the language so that the student can express himself freely. The suggested class size is six to twelve individuals. Students work in small groups, generally seated in a circle with the teacher standing outside the circle. The instructor should act to assist and support the ongoing communication between the students. Initial conversation is in the native language, which the teacher then translates until, in time, the students become more proficient and the conversations become more personal and linguistically more complex. Tape recordings of the sessions and brief sessions on grammar questions provide opportunities for review and clarification.

A potential drawback of this method is the limited variety of topics that are discussed in the target language. This is because it is the general practice that students determine the content of the discussions and they may not know enough about the culture of the target language. For these reasons, some of the basic language needs may be neglected. Another drawback is that not all students respond well to the unstructured class room and the lack of grammatical and lexical terms (Omaggio, 1986).

6. The Total Physical Response Method.

This method of language teaching, developed by Asher et al. (1974), is based on the assumption that a second language is internalized through a process of code breaking similar to first language development. The Physical Response Method (TPR) allows for a long period of

listening (several weeks or months) and developing comprehension prior to production. Responses are given through physical movements. This method focuses on the learner's sensory system as it first fully develops the listening comprehension before engaging the student in active oral participation. Language instructions are given by commands, which the students then "act out" to demonstrate their understanding. Mime and example are widely used tools for this method of teaching a second language. Similar to the direct method, language instruction takes place exclusively in the target language, no native language explanation are given.

Asher (1982) offers three key ideas that govern the TPR method. First, understanding of the spoken language must be developed in advance of speaking. Second, this method argues students should use body movements to respond to oral commands and show comprehension of the material presented. With respect to commands, Asher's research suggests that by using the imperative skillfully, most of the grammatical structures of the foreign language as well as a vast amount (hundreds) of vocabulary can be learned and retained. Asher also claims that teaching of abstract concepts can be achieved successfully. It is believed that understanding and retention are best supported through body movements. Finally, Asher's philosophy is that, as soon as the target language is internalized and understood, speaking will follow naturally. In this method it is imperative that students do not speak in the target language until they feel they are ready, generally after about ten hours of listening. For some individuals, however, it can take weeks or months before the speaking ability emerges.

TPR method encourages role reversal between teacher and student. It is noted that while reading and writing activities are not part of a recommended class lesson, Asher allows for some reading and writing exercises at the end of class, especially if requested by a student.

Positive elements of this method are the warm and accepting atmosphere in the classroom where students are encouraged to show their skills in a creative way. At the same time, it has been noted that some individuals feel inhibited or embarrassed by the TPR activities. The main potential drawback of this method is the incongruence with proficiency goals. However, as an additional technique for certain language learning situations, the TPR method could offer an interesting and catching teaching tool (Omaggio, 1986).

7. The Natural Approach.

This method was developed by Terrell (1982) who based his methodology on Krashen's Monitor Model (1982), a much discussed theoretical model of language learning. The monitor model is not a classroom teaching method, but rather an explanation of how second language skills are developed. Krashen proposed five central hypotheses in his monitor model. First, Krashen distinguishes between acquisition and learning of a second language. Acquisition is a more subconscious process, similar to children's language development. Learning is a more conscious process of language development with rules of grammar. Second, Krashen proposes the natural order hypothesis, which claims that language is acquired in a predictable order which is acquired in a natural setting and not in a formal learning setting. Third, the monitor hypothesis proposes that acquisition initiates all second language performance and fluency while learning (consciously knowing the rules and grammar) functions as "editor" or "monitor." Further, Krashen proposes the input hypothesis. Here he suggests that we acquire more language if we are exposed to tasks "a little beyond" our current level of competence. Finally, Krashen talks about the affective filter hypothesis. This hypothesis states that input can only be effective in language acquisition under affective conditions, such as motivation, self-confidence, good self-image and low level of anxiety. If positive affective conditions are

present, then comprehensible input can “get in,” if they are not present, the language may not “get in.” The Natural Approach Method represents an application of Krashen’s language model. Terrell’s (1977) key argument to his method is that “it is possible for students in a classroom situation to learn to communicate in a second language” (p. 324).

Terrell’s model proposes five main principles crucial to second language acquisition. First, the main goal of a beginning language class is always immediate communication competence (not grammatical structure). Second, with respect to grammar learning, it is suggested that the instructor should modify and improve the students’ grammar concepts avoiding the traditional grammar rule drills of one rule at a time. Third, the main focus in the classroom is on acquiring the language rather than being pressured into learning it (again, according to Krashen’s model, 1982). Forth, the primary elements in conducting language instruction according to this method should be affective factors, not cognitive factors. Finally, this model places great emphasis on vocabulary learning. It is suggested that this is the key to comprehension and speech production (Omaggio, (1986).

The main characteristics of the Natural Approach in the class room are as follows. One aspect of this method is the great importance placed on communication in the classroom. It is even suggested that the entire class period be devoted to communication and that any linguistic form and structure be learned outside of class so that no time is wasted on grammatical or other manipulative exercises. Terrell (1982) points out, though, that structured exercises for outside the class should be prepared carefully so that students understand the concepts and that they are given opportunities for systematic feedback. Students carry the responsibility for their own improvement in the quality of their output. The Natural Approach makes some very clear recommendations regarding error correction. Terrell (1982) claims that speech correction

would not be helpful or advisable in second language learning. He contends that such correction would only have a negative effect on motivation, attitude and performance.

Responses are allowed in both the first and second language. It is believed that this method is very flexible and non-threatening to the student. The students are first exposed to only listening comprehension activities, and they are allowed to give responses in their native tongue.

A potential drawback of the natural approach is obviously the lack of emphasis on proficiency and accuracy. Some argue that the lack of corrective feedback can lead to fossilization. Also, because of this fossilization, the student will miss the opportunity to attain higher levels of proficiency. Another potential drawback for the not-so-motivated student could be the lack of expectation and requirement of language production (Omaggio, 1986).

8. Communicative Language Teaching.

Although teaching of second languages had undergone some changes in the concepts of the learning processes in the brain (through research in psychology) as well as changes in the approaches to teaching with new methods (through education), one very important element in second language acquisition was still missing. Through the teaching methods reviewed here, students had been taught sentence structure and grammar patterns either with drills or through inductive absorption. Furthermore, they had been taught to listen, to repeat, to read, and to translate. However, students had not been taught to verbally communicate in the given target language. In most of these language instruction methods the output of the second language and its actual production was very much restricted. This all changed with the advent of the approach of Communicative Language/Teaching which addressed this missing part in obtaining complete second language proficiency (Lee & VanPatten, 1995).

With this method, a new role of the teacher emerged. The teacher was no longer the exclusive instructor (nor the passive “counselor”) and the student no more the mere receiver of information. As the name Communicative Method indicates, with this method the teacher and student communicate and students are encouraged to communicate with the other students. In other words, the learners now had the opportunity to converse with each other in the target language, dealing with real-life messages and expressions. This approach made the class sessions much more dynamic, creative, and expressive. The rigid structure and the grammar drills had disappeared.

The communicative language teaching method added an important element to language teaching. However, adoption of this new emphasis on two-sided communication was slow. Often the concept of communication was interpreted and exercised as a question-and-answer approach where the teacher was still in control (Omaggio, 1986). Nevertheless, many instructors today prefer and use textbooks written in the communicative approach. These texts offer a variety of techniques and stimulation for the student, always aiming at keeping the student interested and enthusiastic in exploring the target language, the culture, and the people.

9. The Silent Way: Learning through Self-Reliance.

The Silent Way, developed by Gattegno (1976), is a method of teaching where the teacher plays a mostly silent role acting as a model by facilitating the student to discover rather than remember and repeat the material to be learned, by using colored wooden sticks of different lengths, called Cuisenaire rods (this concept was first developed by Georges Cuisenaire for learning math concepts), (Stevick, 1980). The colored rods represent different sounds and pronunciation, the instructional material, which also include color coded symbols for vowels and consonants as well as pictures and objects, invite the student to manipulate and experience

with the target language, thus, encouraging self reliance and increasing intellectual potency. An underlying principle of the Silent Way is that it draws on the students' native language experience as they experiment and create new structures in the target language based on their own inner criteria for accurate or inaccurate linguistic formations. The instructional material allows the teacher to direct the student in a silent way to accuracy, as the students become the monitor of their own output. The students are able to use the target language in a meaningful way (Omaggio Hadley, 1993). This method does not advocate any rote learning for memorization; it fosters creativity as well as self-correction. An important aspect of the Silent Way is to create a relaxed atmosphere in the class room, yet steering to a conscious and serious learning experience.

A potential drawback of the Silent Way may lie in the fact that students seldom hear the target language spoken by a native speaker, especially during early learning of the language (Omaggio Hadley, 1993).

10. Suggestopedia, the Lozanov Method.

In the last section of methodologies, I will describe the method of Suggestopedia, the method I used for my previous research project to investigate the effect of baroque/classical music on second language acquisition. It was the lack of grammar instruction which I felt was missing from a complete and successful language class, thus, leading me to my present research project where I am investigating the effect of color-coded grammar presentation, a structured grammar input within a very communicative style language lesson.

The method Suggestopedia, also known as Suggestive-Accelerative Learning and Teaching (SALT) and the Lozanov Method, was developed about thirty five years ago by Dr. Georgi Lozanov, a psychotherapist, physician, and researcher, from Sofia, Bulgaria. His method relies

on the assumption that it is possible to increase language intake dramatically by tapping the paraconscious reserves of the brain. By paraconscious Lozanov means the subconscious level. For part of the class activity (reading of a text in conversation form) he induces deep relaxation which is brought on by baroque music (Bancroft, 1999). Lozanov was interested in the effects of music on our mind and body. He theorizes that Baroque music slows body rhythm; he refers to slower heart and respiration rate. According to Lozanov, music induces relaxation, and a calmed state of the body facilitates mental functioning and learning. Lozanov argues that this kind of music induces alert relaxation – alert mind, relaxed body (Ostrander & Schroeder, 1981). Basic tenets of Suggestopedia are accredited to several disciplines including classical music, yoga, parapsychology, and autogenic training, all of which are generally not acknowledged as mainstream scientific inquiry (Chastein, 1988).

Lozanov's suggestive-accelerative teaching and learning method is based on the concept that the left and right hemispheres have separate capacities and processing skills, yet work together as a whole on a more complex scale. Lozanov suggested that our learning capacity can go far beyond what we achieve with traditional methods by stimulating the right hemisphere of the brain with specifically chosen music (baroque/classical). In turn, these right hemispheric processes support and speed up the intake of knowledge by the left hemisphere of the brain (Schuster, 1976). This aspect of the Lozanov method is consistent with modern cognitive neuroscience theory, which is focusing more on interhemispheric interaction.

Another aspect of this model is its sociopsychological view. Followers and practitioners of the Lozanov method Suggestopedia defend its philosophy. However, in the mainstream of education, teachers are generally not in favor of the above mentioned disciplines or they are not

familiar with that said teaching approach. Nevertheless, Suggestopedia has found enthusiastic followers on all continents.

In conclusion of this chapter, I might quote Krashen (1983) who recognizes that beyond methodologies teachers should bring their own ideas and intuitions according to their experiences to the class; he says “teaching remains an art as well as a science” (p. 261).

CHAPTER V: Literature Review of Second Language (L2) Grammar Acquisition.

A. Literature Review of L2 Grammar Acquisition, Focusing on

Literature Review of Proposed Prerequisites for Learning Like

Noticing, Attention, and Awareness of Newly Presented Linguistic Material, as well as a Look at Research in the Field of L2 Input Enhancement.

The following section provides a summary of SLA research with the main focus on grammar acquisition, a field that is of special importance to my study. In recent years, L2 input and grammar have received much attention, some of which will be discussed in the following paragraphs.

Ellis (1990) who is a strong advocate of formal, teacher-fronted grammar instruction within a necessary communicative teaching model, states that formal instruction is needed to promote advanced levels of target language attainment (Ellis, 1990). He advocates such formal instruction as a type of consciousness-raising input, a term which Sharwood Smith (1981) refers to as input enhancement (see next paragraph). If this type of focus on form is subsequently followed by communicative activities, the learner will notice the input containing the presented grammar features and may focus with increased attention, thus, learning of L2 through form-focused instruction may occur (Ellis, 1990).

Sharwood Smith (1981) is among the first researchers of SLA with a keen look at the notion of consciousness-raising input. He explains it as increased learner awareness of particular linguistic features, a deliberate focus on form of the language, which should facilitate the development of L2 acquisition. This concept has become prominent during the past decade. Sharwood Smith (1981) describes noticing as a critical first step, a trigger for language processing. In 1991, he re-examines the concept of consciousness-raising in language learning and calls the salient input “input enhancement”, a practice which can be achieved through different teaching strategies. Students can be made aware of grammatical features by various strategies such as problem-solving tasks or teacher-fronted grammar lessons (Fotos and Ellis, 1991). Some other strategies which have been suggested to increase learners’ consciousness include corrective feedback as a consciousness-raising device, as well as warning gestures and facial expressions by the teacher upon the student’s error (Lightbown & Spada, 1991). Furthermore, italicized script and underlining have been used as grammar markers and modes of grammar enhancement (Sharwood Smith, 1991). These are some techniques which might influence the consciousness-raising process for better processing and acquisition of L2. Whichever method is applied, Sharwood Smith (1991) points out that these form-enhancements are seen as “flags” in the input with the hope that these “flags” will be used to develop the student’s own internal mental “flag” when needed for a specific language formation in the brain, and, thus, enhance learning. In a later paper (1993), Sharwood Smith makes a distinct differentiation between consciousness-raising and input enhancement. He points out that when consciousness is raised, one can imply that the learner’s mental state has been altered by the input, thus, one could conclude that input becomes intake. On the other hand, input enhancement means only that teachers can manipulate certain features of form as input,

however, one cannot know what the learner does with that input, one cannot automatically assume that teacher (externally) induced input becomes intake. Sharwood Smith (1993) reminds his readers of the LAD, language acquisition device (Chomsky, 1977), the innate learning system, a special language processing ability, which does an excellent job of its own, highlighting different aspects of the input and, thus, moving the information into the developing system for later output. These findings by recognized scholars are very important for this study of color coding German grammatical features as they support the enhanced input theory for higher achievement in learning.

The view that advanced levels of L2 attainment can only be achieved with a thorough understanding of the grammatical forms of a language is now widely accepted by linguists as well as other disciplines (Fotos & Ellis 1991; Fotos 1993; Leow 2000; Wong & Simard 2004). In her article, Fotos (1993) emphasizes the two types of human knowledge. She makes the distinction between explicit knowledge where the learner knows the grammatical rules and implicit knowledge where the learner is able to use those forms unconsciously correctly in meaning-focused communication in the target language. The former is achieved through formal grammar instruction, while the latter is developed through attending to form-focused L2 input followed by meaning-focused, comprehensible L2 output (Fotos 1993; VanPatten 1992).

Leow (2000) looked at the role of awareness in foreign language learning and examined the effects of awareness versus unawareness on 32 adult students. Leow (2000) concluded from the results of his experiment that learners who noticed the targeted grammatical features performed “significantly better” than those students who did not notice, i.e., than those students who did not become particularly aware of such grammatical features. Based on his data, Leow (2000) postulates that awareness of linguistic features may play an important role in the

subsequent processing of L2. Supporting his findings is the “Noticing Hypothesis” proposed by Schmidt (1990) saying that awareness plays a crucial role in the L2 learning process; i.e., learners must first become consciously aware of some particular form in the input before any intake for further processing of that form can take place. This is in support of Schmidt’s (1990) argument that, without focal attention and without awareness of a particular feature, learning of L2 cannot occur.

VanPatten (1992) contends that for successful acquisition of a second language, learners need access to form-meaning, comprehensible input that is meaningfully and communicatively presented in order to acquire the grammatical properties of a second language. VanPatten (1992) emphasizes the idea that learners should attend to one grammatical rule at a time, which then will be processed for decoding meaning. Based on his research, Van Patten (1992) claims that students’ focus/attention is essential for enhanced language acquisition.

Lightbown & Spada (1991) state that meaningful, naturalistic input alone is not enough to master the grammar of a language, rather, learners need exposure to the grammatical features in order to achieve high levels of accuracy in the L2. They refer to Sharwood Smith’s (1981) argument that a high degree of L2 learning can be fostered by providing consciousness-raising material and activities with the goal of drawing the learners’ attention explicitly to some specific linguistic features. Input enhancement can make the learner aware and pay attention to a linguistic feature which otherwise could have been missed (Lightbown & Spada, 1991; Wong & Simard 2004).

Looking at the above stated research findings of scholars in the field of language acquisition, it seems to be in place to argue the value of noticing, attention and awareness of new instructional language material to be learned by the language student. Thus, it also seems

to be a logical conclusion that such new language material be made more salient to help draw attention to said features. Color-coding the German grammar could be considered an appropriate and promising tool to achieve this goal.

Also, with respect to grammar teaching, there seems to be a general consensus among the above researchers, that a language cannot be fully acquired without learning grammar, especially for advanced proficiency. The above mentioned scholars emphasize grammar instruction; however, most advocate that all new language features be taught in a meaningful, understandable and communicative concept (Wong, 2005).

B. Literature Review of the Effects of the Use of Color in the Teaching-Learning Process.

Fifty years ago, when Dale (1954) discussed the use of color in visual materials in the 1960s and 1970s, educators as well as researchers started to look at color as an added dimension in the teaching-learning process.

Advances in the industrial technology as in computers, videos, etc. have stimulated class room activities with innovated presentations of strategies, instructional routines, learner interaction, feedback routines and the use of color as an instructional variable, the latter of which would clearly add a dimension unobtainable in monochromatic illustrations. Dwyer & Lamberski (1972) looked primarily at the effect of color in materials used in the teaching-learning process, also keeping in mind the possibility of an unmanageable complexity of information for the student due to a possible overuse of color or improper use of color. They found that color enhanced the instructional material making it attractive, more salient and more effective in facilitating specific kinds of learning objectives (Dwyer, 1978).

In another study, Lamberski (1980) assessed the effect of color vs. black/white coded learning material, which was incorporated into self-paced instruction and test materials. The study showed that color-coded self-paced instruction materials were superior to the black/white coded materials. This positive result was found in both areas of interest: 1) immediate recall as well as 2) a six-week delayed test, i.e., students' retention level of different cognitive tasks was facilitated by color-coded material. However, the results showed also that the color-coding had a more positive effect on visual tasks as drawing and identification rather than on more verbal tasks as terminology and comprehension. Lamberski concluded that the effectiveness of color-coded material was closely linked to the students' sustained attention and interaction with the content of the presented learning material.

Another group of researchers (Wichmann, Sharpe & Gegenfurtner, 2002) questioned the influence of color on memory with non-academic material; they ran an experiment to investigate the influence of color on visual memory of different nature scenes. They used four different categories of pictures of natural scenes. Category 1) consisted of landscapes of fields and forests (trees) around Tuebingen, overall "green" landscapes and all similar in shape. Category 2) were flowers of different kinds, widely different in color, however, rather similar in shape, Category 3) were pictures of natural rock formations with an overall reddish color and large variation in shape, and Category 4) were images of man-made objects which had large variations in color as well as in shape. The researchers used 24 images for each category, 96 images in total. Half of the pictures were shown in color, the other half in black and white. After conducting a series of experiments, the researchers found that color played a significant role in recognition memory for natural scenes; they reported 5% – 10% better results for colored images than for black and white images. The researchers concluded that the positive

results were due to cognitive abilities since color information is stored in memory and that color increases attention and aids retrieval of stored information.

C. Literature Review of the Learning Processes and Memory.

The scientific study of the human learning processes and memory is a fairly new discipline, which developed over the last hundred years and has centered in the discipline of cognitive and bio-Psychology (Pinel, 2000). This is the area of science through which much knowledge has been gained as to the age old curiosity and question about the phenomena of human thinking, language, learning and feeling. It was not always clear that those properties are rooted in the brain. Cognitive psychology embraces a wide range of studies about the human brain, investigating the human mental processes of acquisition of knowledge, of language learning and memory, including perception, attention, encoding, storage and retrieval of information, creativity, problem solving, decision making, reasoning, as well as mental and emotional developmental stages, and more (Haberlandt, 1997). This research is directly linked to language acquisition as it offers new insight into the different mental pathways involved in language production and gives linguists the necessary background for convincing foreign language teaching approaches. Other disciplines, like biology, linguistics and philosophy, anthropology, computer science and mathematics, all have influenced and are part of cognitive psychology. Modern technology is crucial for the study and mapping of the mental and emotional functions in the brain (Kellogg, 2003). For this dissertation, only two of these devices will be mentioned. A PET scanner (short for positron emission tomography) detects areas in the brain of high metabolic activity using injections of radioactively labeled water; and a fMRI (functional magnetic resonance imaging) scanner also detects metabolic changes in the brain, but sending a powerful magnetic field through the head. Both devices measure changes

in the concentration of oxygen in the blood, which give a picture of locale of the different parts in the brain and their functions (Kellogg, 2003). Please, refer to Chapter II, B., Figure 4, p. 12; Figure 5, p. 13, and Figure 8, p. 17. In addition, the computer industry supplied researchers with state of the art technology which enables researchers to record, combine and evaluate huge amounts of data for further laboratory testing (Haberlandt, 1997).

Historically, there was a divide between scholars of a theoretical scientific approach to language acquisition and teachers of a more pragmatic approach to teaching foreign languages. This trend is changing fast, and there can be seen increased teacher research and university research programs resulting in collaborative efforts to address the question as to the learning process and memory in the field of L2 acquisition (Wong, 2005).

Human memory is not a single cognitive function, it consists of several systems and stages of brain activities involving different properties and areas of the brain. Memory is a complex system of which much is understood by science, yet research is continuously advancing to gather more knowledge about the intricate memory system (Banich, 1997). In broad terms, researchers distinguish between two main stages of memory: *short-term memory* and *long-term memory*. Short-term memory (also referred to as *working memory*) is what the name says: an immediate memory of new information or stimuli just perceived, is kept active for just a short time (seconds), and it can hold only a limited amount of information temporarily (Carlson, 1998) if not particularly rehearsed. Short-term or working memory is viewed by researchers as a very dynamic cognitive processor as the first important mental stage for manipulating, coordinating, selecting and processing new stimuli (Haberlandt, 1997), and it is available for immediate access. If attended to, this information can then move on to the next stage, long-term memory. This seems to indicate that any enhanced material (like color coded

German grammar) would have an advantage over plain material in the selection process of the memory system.

Linguists and psychologists actually post the *sensory memory* as the earliest stage of the memory system (Pinel, 2009), a very transient memory, a pre-stage to the short-term memory, where new information activates very briefly the *sensory receptors* and is stored in the *sensory register* to be passed on to the short-term memory system (Anderson, 2005). This first stage is designed to hold the new information (without meaning) in a “holding bin” for proper identification and pattern recognition (meaning is attached which is derived from a matching representation stored in long-term memory), and to make sure that the next stage is free to process that information. At the same time, the sensory memory system is constantly bombarded with new information, from the visual as well as from the auditory systems, and needs to be cleared quickly in order not to suffer from overflow. A consequence of this process is the quick decay of incoming information (Hunt & Ellis, 1999). Paying attention to sensory memory generates information in short-term memory. It seems plausible that presenting German grammatical features in color would alert the sensory receptors to special information for further use.

From short-term or working memory, information passes to long-term memory where information is stored (mainly in the hippocampus, but not exclusively) in nearly an unlimited amount for an unlimited time or for, at least, a very long time. Science has confirmed two types of memories: *explicit* and *implicit* memory, each involving different parts of the brain from the left as well as from the right hemisphere, a collaboration system which is encouraging for the use of color in learning of German grammatical features as “flag” (cue) to register and recall (Sharwood Smith, 1991). However, retrieval from long-term memory is especially

effective through *rehearsal*; there, a distinction is made between *maintenance rehearsal* and *elaborate rehearsal*, the latter being the superior method (Kellogg, 2003). Enhancement through color coding is considered elaborate rehearsal (Kellogg, 2003); this is a significant finding for this study.

Explicit memory is referred to conscious memory, to conscious recall of any information at will. *Implicit memory* works without conscious recall or recognition, also called intuitively memory (Pinel, 2009; Fotos, 1993). With respect to my study, both of these systems would be involved in the retrieval of German grammar; however, the aspect of implicit memory becomes very interesting for the color coded German grammar, it is conceivable that this system is especially suited for color memory on the unconscious level.

Another function of the memory system in the brain might be relevant for my study of enhanced grammar input: explicit long-term memory has two properties: *semantic* and *episodic* memory (Rubin, 2006; Wishaw & Wallace, 2003). The semantic memory refers to knowledge and memory of a broad range of general information, world knowledge, rather impersonal, whereas episodic memory is a memory of personal experience of particular events, situations, pictures, etc. it is also called the autobiographical memory (Pinel, 2000). Again, referring to my experiment, one gets the impression that in episodic memory color-coded grammatical features stand out and may play a favorable role in recall exercises of specifically enhanced grammatical features.

A study described by Kellogg (2003) gives further reason to assume that color-coded grammatical features can be considered helpful cues for the recall process. In that study a comparison was made between *free recall* and *cued recall* with a remarkable result: in free recall a third of the words were remembered, whereas in cued recall double the amount of

words were successfully recalled (Kellogg, 2003). Science has shown with PET and fMRI that the left and right prefrontal cortex “light up”, i.e., is actively involved in episodic encoding and retrieval (Kellogg, 2003). A cued object will trigger special attention, a function which is considered an important aspect for the learning and retrieval process. Science could identify attention in the brain when it increases neural activity. There are numerous scientific experiments showing how attention sparks up parts of the brain, and it is concluded that this activity supports mental functions (Begley, 2008).

Further, science posts that the incoming information entering the primary visual cortex is divided into *spatial memory* (through the *dorsal pathway*, the “where” pathway, responding to location and direction) and into the *object-recognition memory* (through the *ventral pathway*, the “what” pathway, responding to a large spectrum of stimuli to objects) (Pinel, 2009, Kellogg, 2003). (Please, refer to figure 7, page 16). Also this particular structure in the brain might favor enhanced color-coded material (over black and white) for special treatment for further use in the memory pathways.

Also *emotions* and *mood* play a significant role in language acquisition and memory, processed mainly in the amygdala, the limbic system, the emotional center in the brain (Pinel, 2009). Emotions are associated with feelings, attitudes, behavior, thoughts and learning (Sousa, 1987, 2008), they originate as cognitive or as non-cognitive (instinctual) feelings and expand across the brain touching and influencing many other brain functions (Springer & Deutsch, 1998). Dr. Paul Ekman (1999) issued a list of basic universal emotions: joy (pleasure, happiness), fear, anger, disgust, sadness, surprise; the list was expanded in 1990 (too long to quote here). It is believed that emotions are influential at the sensory input level and thinking. Neuroscience has mapped emotions and mood responses successfully across many parts of the

brain (Banich, 1997), indicating that, among other areas, also learning is being influenced by emotions, either positively or negatively. Emotions are part of our human everyday experience. Yet, only until recently has emotion become part of mainstream cognitive science (Hunt & Ellis, 1999) and is slowly filtering into the awareness of classroom academia.

Emotions and feeling also affect strongly our *attitude* and *motivation*, the desire and drive to engage in something to do (Krashen, 1982, also this paper p.38). Motivation ranks among the key ingredients for learning (Oxford, 1990). It has been found that interesting and meaning-bearing input (VanPatten, 1996) as well as real life instructional material (pictures, native objects, inter-active games, etc.) can greatly enhance students' focus and involvement with new linguistic material (Oxford, 1990). Many of these elements can be found in today's text books, however, grammar is still being taught in relatively mundane concepts. Those were repeated comments made to the experimenter by subjects of the German class room experiment; they found the color concept "fun," engaging and helpful for the testing part of the experiment.

Other researchers in the linguistic field, like Oxford (1990), suggest relaxation, deep breathing, meditation or music to reduce anxiety and, thus, increase learning.

Of particular interest to my study is the question of how does color influence mood or emotions, which in turn might influence the learning and memory process of German grammatical features (most probably through the implicit memory system). Experiments have been conducted as to a relationship between color and emotions, and it has been reported that color plays a role in creating different emotions and moods (Kargere, 1949). Emotions and thinking/learning are both faculties of the brain and they are interrelated, they both influence each other in their own way. Scientific studies have been conducted as to the *mood congruence*

effect, which showed that the material was best learned when repeated in the same environment and under the same induced mood state (Kellogg, 2003), indicating an overriding emotional effect on learning. The same finding is reported by Hunt & Ellis (1999) with the term “Mood-State-Dependent Effects” (p. 306). Mood also plays a significant role in the mental process of encoding information, processing and retrieval of information (Hunt & Ellis, 1999). For that experiment researchers used mood inducing techniques, as well as congruent testing material. Based on their findings, the happy subjects came out with the best performance whereas the sad subjects showed the poorest results (Hunt & Ellis, 1999).

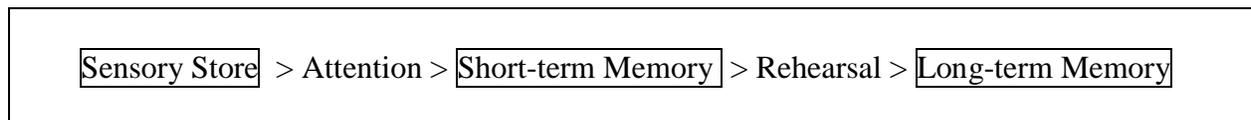
Robust research in mood and color relationship has been conducted especially for the industrial/commercial world. A study at the University of Loyola, Maryland, investigated the effect of color and brand identity. Their results came out overwhelmingly in favor of color: recognition of the brand name in color increased sales by 80%, a lucrative finding (Morton, 2009). There are countless modern business branches, from interior designers, car manufacturers, and pharmaceutical companies to color therapists in hospitals and many more, who have been awakened to the power of color. There is increasing interest in lectures and seminars featuring visual effects of color, psychological effects of color, of color concepts/coordination in design and architecture for interior and exterior use (Colorcom, 2009). There is a demand for a new breed of professionals, for color consultants, a relatively new profession which reflects the real desire and importance for a man-made color world to stimulate the senses and increase well-being.

As discussed in the previous paragraphs, the evidence of the brain capacity for mental and emotional processing has been widely established and has led to creation of numerous paradigms pertaining to said mental processes.

Many models have been presented to describe the architecture of those mental processes for information from input to output, about the learning processes and memory.

Here, three examples of such symbolic models are presented.

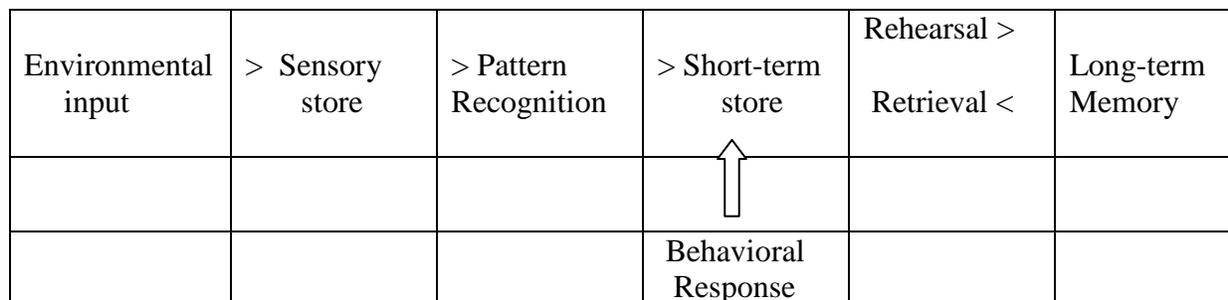
1. John R. Anderson (2005) offers the following model (p. 176):



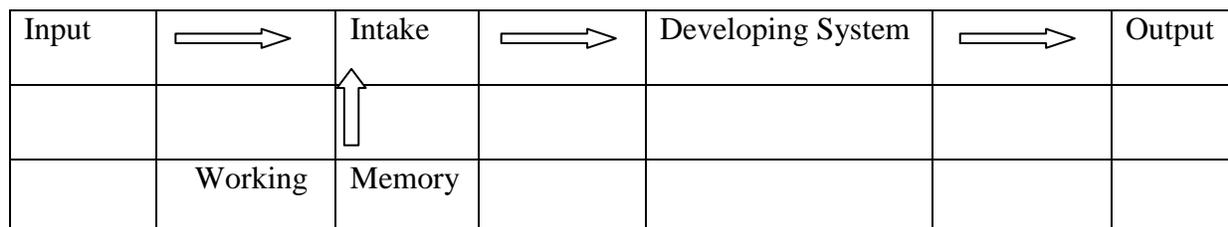
(“Figure 6.4: A model that includes an intermediate short-term memory. Information coming in from the environment is held in transient sensory store from which it is lost unless attended to. Attended information goes into an intermediate short-term memory with a limited capacity to hold information. The information must be rehearsed before it can move into a relatively permanent long-term memory”).

2. Ronald T. Kellogg (2003, p. 11, Fig. 1.3.) sees the mental organization of information processing according to the following symbolic model:

Source: Adapted from Atkinson & Shiffrin (1971).



3. Lee & Van Patten’s model exemplifies a linguistic viewpoint of the process of language acquisition and is widely accepted, as explained and illustrated by Wynne Wong (2005, p. 28) in the following figure:



In the neuropsychology field, these symbolic models are based on the belief that the mind is made of a hierarchical system with many functions, as has been described in previous paragraphs.

D. Literature review on FD (field dependent) and FI (field independent) learners, As well as Group Embedded Figures Test (GEFT).

In my experiment I took two different learning styles into consideration and tested the individual participants accordingly, i.e., the Group Embedded Figures Test (GEFT) was administered in order to determine whether a student was a field-dependent (FD) or a field-independent (FI) learner. This would give the experiment an added ingredient as to the validity of the test results, and consequently enhance future recommendations for the use of color-coded grammar in the class room. The GEFT is designed to assess perceptual and analytical ability. It comes in a booklet with 25 geometrical figures; the task is to find and trace a previously seen simple figure within a larger complex figure with obscured embedded figures. There is a time limit for the tasks. The scores indicate the extent of competence at perceptual disembedding the small figure within the larger figure (Witkin, Oltman, Raskin, & Karp, 1971).

The researchers Moore & Francis (1991) based their study on the established concept that there are two basic groups of learners with different cognitive styles, the field-dependent (FD) and the field-independent learners (FI). The first group tends to absorb information on a global scale, not being able to modify the presented information but rather accept and interact with it as presented. The other group of learners can look at the presented information as a whole and, at the same time, is able to identify precisely the critical information contained in a

complex presentation and organize the instructional content. Research has shown that field-independent learners outperform field-dependent learners.

This study was conducted to assess the effect of color-coding instructional material presented to the two different types of learners, whether color-coding would positively affect field-dependent learners' deficiency in organizing and structuring such material.

The subjects for this experiment were one hundred nineteen students from a basic educational psychology course at the Pennsylvania State University. They were classified as field-dependent, field-neutral, or field-independent on the basis of their performance on the Group Embedded Figures Test (Witkin, Oltman, Raskin, & Karp, 1971). The instructional material was presented coded in black and white and in color.

The stimuli presented to the three different groups were a 2,000-word instructional booklet on the anatomy and functions of the human heart, terminology of which had to be remembered and reproduced.

The researchers found that the single color-coding strategy (black and white) did not seem to be of sufficient impact on the information-processing strategies of the field-dependent learners. However, the effect of the color-coded instructional material met the expectations of the researchers; the field-dependent learners did improve their learning achievements on the verbal tests. The field-independent learners did not demonstrate any advantage of the color-coded versus the single color-coded strategy; however, the researchers speculate that due to their brain organization they may not have utilized their special skills to process the information deeply.

While the researchers found that the color-coding was an effective tool for maximizing the learning performance by field-dependent learners, they also suggest further studies to

replicate their findings that continued testing would be indicated for credibility of color-coding instructional material for improved learning.

Dwyer & David (1991-1992) conducted a study to assess the effect of color-coding visually as well verbally presented instructional material to field-dependent/independent learners. The researchers stress the fact that field-dependence/independence has been examined more closely than other cognitive styles, probably due to the fact that the pertinent characteristics are directly applicable to the learning process. In this study, the researchers looked specifically at any interaction between the variables of field-dependency and color across both visual and verbal oriented tests. The subject content of the study consisted again of a 2,000 word instructional booklet on the anatomy and functions of the human heart. The tasks consisted of learning terminology, identifying locations, construction relationships and engaging in problem solving activities. In this test, the researchers were especially interested in the correct positioning of the verbal symbols with respect to one another and in respect to their concrete referents, they wanted to measure the ability of the student to use visual cues to discriminate one part of the heart from another and to combine specific parts of the heart with their correct names. Color-coding is considered a possible helpful tool to maximize learning capacities. Research results confirm this stipulation. The researchers have found that color-coding helps learners organize and categorize instructional information creating a pattern for better interpretation and adjustment to the task. Dwyer, in this paper, also refers to other research conducted which looks at the effect of color-coding information. He states that results of those experiments support the idea that color-coding provides a strategy for the learner true for field-dependent learners since their learning strategies tend to be more of global perception

characteristics, and color-coding could be of an advantage to provide an increased structural perception of the new information.

CHAPTER VI: Experiment on the Effect of color-coded German Grammar.

I conducted an empirical study of the effects of color-coded grammar on German language learning. I wanted to find out, in a natural German language class setting as well as in a controlled experiment in a Psychology class, whether or not color would facilitate the learning and retention of aspects of German grammar, and if so, to what degree would color affect second language acquisition and memory, and who would most benefit from such a treatment.

The major goals for the experiment were:

- a) isolate the effects of color on the acquisition of L2 grammar,
- b) gain a clear understanding of the kinds of German vocabulary acquired (masculine, feminine and neuter articles with their respective nouns, as well as articles with nouns in context with accusative and dative prepositions),
- c) determine whether color would aid in the above tasks,
- d) find out whether articles and nouns are more easily learned in isolation or in context within complete sentences,
- e) investigate the concept of different learning styles, i.e. FI (field independent learners) and FD (field dependent learners) in the context of color-coding,
- f) conduct the study under careful control over student selection and experimental procedures.

Methods

Participants.

Students from five beginning German 104 classes (beginner level) at the University of Kansas were randomly chosen: the color group (experimental group) consisting of 36 participants (19 males and 17 females) and the non-color group (control group) consisting of 30 participants (21 males and 9 females). The native language of the participants was American English, all students were enrolled in the German 104 class to learn German, some to fulfill a requirement for an advanced degree, others were just interested in learning German “for fun,” all had to follow a pre-planned syllabus, working with a textbook and a workbook with ample grammar exercises. Careful consideration to the class syllabus was given so that the grammar tested in the experiment would always be presented one or two weeks before it was scheduled for the German 104 class instructions. The subjects had no or insignificant previous knowledge of the German language. They were given a consent form, issued by the University of Kansas for all experiments involving human subjects, as to their voluntary participation in the experiment. The instructors of the German classes agreed to be “observers” of the experiment. For the experiment in the controlled laboratory setting in the Psychology Department, students from beginning Psychology 104 classes were randomly chosen: 41 subjects (17 males and 24 females) for the color group (experimental group) and 41 subjects (19 males and 22 females) for the non-color group (control group). The preparation procedure for this group was the same as for the group of the German 104 classes. They were given a consent form, issued by the University of Kansas for all experiments involving human subjects, as to their voluntary participation in the experiment. They also were asked to fill out a questionnaire which would give information about their foreign language and German language background. The native

language of the participants was American English; the subjects had no previous knowledge of the German language. Each experiment session in the Psychology Department was observed by a master's student from the German Department.

Stimuli.

Both groups, the experimental group as well as the control group, in both studies (in the natural setting of a German 104 class (Experiment I) and in the controlled laboratory study in the Psychology department (Experiment II) were presented with German grammar material which were made salient through learning material in black framed boxes. This feature alone can already be considered as enhancement of the grammatical features for both groups. However, this experiment was conducted to find out whether or not color-coded grammar would aid in the learning process; thus, in addition to the grammar in black boxes/frames, said grammar was color-coded for the experimental group, whereas for the control group the grammar was presented only in black and white.

1. Design and Procedure I, General Overview (followed by a detailed description 2.):

The procedure of the experiment started out with the participants signing an agreement statement (consent sheet) as to their voluntary participation in the experiment, according to the rules for research on humans issued by the University of Kansas. Two examples of which are included in the appendix. This consent form explained what the students could expect during the experimental periods, which was further explained by the experimenter. Both groups were informed that the experiment was set up to test second language acquisition, but no explanation was given about the role of color or non-color in the experiment. To the students in the German class it was pointed out that the pertaining activities of the experiment would not interfere with the syllabus of their class, but rather support their future learning of important parts the German

language, so that their time was not wasted on an unrelated subject matter. All experiment participants were also asked to fill out a questionnaire which would give information about their foreign language and German language background.

The design of the experiment consisted of several steps (see appendices): an introduction of the German article in the nominative case (der, die, das) and the corresponding nouns on large flash cards, followed by a vocabulary list of the particular grammatical features with nouns in black framed boxes, which were color-coded for the experimental group and black and white for the control group. Then the subjects were given a study sheet with the same material, again with color-coded grammar for the experimental group and a study sheet in black and white for the control group, followed by a task sheet in which the subjects in the experimental group had to highlight the targeted grammar with color whereas the subjects in the control group had to highlight the grammatical features with grey/black pencil, always within the black boxes. The next exercise was a study sheet, i.e., the subjects were given another opportunity to internalize the grammar by reading over the same material, color-coded for the experimental group and black and white for the control group. The next step was a test of the previously presented material, subjects of both groups, the experimental as well as the control group, had to fill in the blank black boxes with the correct articles as best as they could remember; these test sheets were the same for both groups. The time frame for each exercise was carefully monitored for both groups, which varied between two to three minutes according to the length of the work sheets and test.

The experiment for the study in a natural setting of a regular German 104 beginner's class (Experiment I) was administered on 14 days with 25 minutes each and was spread out over a period of seven weeks. The new material was introduced by the experimenter, this

activity was followed by study sheets, then task sheets which had to be filled in by the subjects; the experiment cycle of each first day with new grammatical material ended with a test (immediate recall), the format of which was identical for both groups. This activity cycle was then repeated the following day exactly as presented the previous day. After one week, the same material was re-tested and again after four weeks, however, without any further exposure of the targeted grammatical features. This experiment cycle refers to the study in the natural setting of a regular German 104 beginner's class. (The laboratory study in the Psychology Department followed a shorter time frame which will be discussed later). The goal was to find out how much of the grammatical material was remembered 1) on the first day of presentation of the grammatical material, 2) after one repeat day, 3) after one week without any repetition exposure of the grammatical material, and 4) after 4 weeks without any repetition exposure of the grammatical material.

For the controlled laboratory study in the Psychology Department (Experiment II), the procedure of the experiment also started out with the participants signing a consent sheet, two examples of which are included in the appendix. As mentioned before, this consent form explained what the students could expect during the experimental periods, which was further explained by the experimenter. Both groups were informed that the experiment was set up to test second language acquisition, but no explanation was given about the role of color or non-color in the experiment. They also were asked to fill out a questionnaire which would give information about their foreign language and German language background.

While the controlled laboratory study in the Psychology department followed the same basic German grammar presentation, study, task and test procedure as did the experiment in the natural setting of the German 104 beginners' class, the limited time frame of three experimental

days called for shorter text exposure as well as fewer testing intervals. The experiment was administered on three consecutive days with sessions of one hour each per group. Subjects in the laboratory study were not given a repeat day to refresh their memory, neither were they tested after one nor after four weeks interval. In the laboratory study, memory was tested on the first exposure day (immediate recall), and then again without refresher material a second time the following day. The subjects in the controlled laboratory study had no previous knowledge of the German language.

The Group Embedded Figures Test (GEFT) was administered equally to the experimental group as well as to the control group in both experiments, in the natural setting of a German 104 class (Experiment I) as well as in controlled laboratory setting of Psychology 104 classes (Experiment II). Explanation of the GEFT is explained on page 54 and the Appendix O, page 169. Students were not given information about the purpose of the test.

The subjects were also asked to fill out an evaluation sheet in which they could express their opinion about the experiment.

2. Design and Procedure II, Detailed Description.

Due to the different environments of the two experiments, one in the natural German beginner's class (which will be referred to as Experiment I), the other in a controlled laboratory setting in the Psychology Department (Experiment II), the treatment and analyses of both experiments will be described separately; first the Experiment I, followed by the Experiment II.

A. Day-by-Day Procedure of Experiment I (in the Natural Environment of the German 104 Classes).

Week I

On the first day, students were given a short explanation of the study without any details as to the particular goals of the experiment, as described in the previous section. They were asked to sign a consent form, issued by the University of Kansas. Subjects also were asked to fill out a questionnaire which would give information about their foreign language and German language background.

Day 1: Beginning of the actual experiment. The design of the first day of the experiment consisted of an eight-part activity, the first four steps treated articles and nouns in isolated concept (non-contextualized), ending with a test; steps five to eight consisted of articles and nouns embedded in context within a complete sentence.

Step 1: Introduction of the German grammar concept. The article “der, die, das” with their respective nouns were introduced in color (der, masculine, in blue; die, feminine, in pink/red; das, neuter, in grey/black) and were explained in English, supported by flash cards, in isolation, again in color for the experimental group and in black and white for the control group, (see Appendices E and F).

Step 2: Vocabulary of masculine, feminine and neuter articles and their respective nouns were presented on a study sheet with three rows, in isolation: row 1) masculine, row 2) feminine and row 3) neuter), in color for the experimental group and in black and white for the control group, (see Appendices G and H).

Step 3: The same vocabulary in isolation, however, as a task sheet, this time not in rows but scrambled and only nouns without articles. Subjects of the experimental group had to fill in the articles in front of colored nouns; subjects of the control group had to fill in the articles in front of black and white nouns, according to the correct genders.

Step 4: Test sheet in black and white for the above articles in front of their nouns, for both groups, the experimental group and the control group.

Step 5: Articles and nouns embedded in complete comprehensible sentences, starting with a study sheet with a short story “Ein Tag an der Ostsee in Deutschland”, with articles “der, die, das” and their respective nouns, in color for the experimental group and in black and white for the control group (see Appendices I and J).

Step 6: The same story as a task exercise where, for the experimental group, the masculine article and noun had to be colored in blue, the feminine article and noun in pink/red, and the neuter article and noun with pencil in grey/black. The control group had to mark all articles and nouns with pencil in grey/black (see Appendices K and L).

Step 7: Another task sheet, where articles had to be written in front of nouns. For the experimental group, the nouns were marked in blue, pink/red and grey/black according to their gender. For the control group the nouns were presented only in black and white.

Step 8: The identical material as a test sheet in black and white for both groups (see Appendix M).

Day 2: Repeat activities and tests from day 1, the previous day.

Step 1 to Step 8: The second day was a repeat exercise of the previous day 1, in order to refresh the subjects’ memory, and to find out what influence a second time of exposure of newly learned material would have on recognition and memory after one day.

Day 3: Post test after one week and introduction of the accusative case of the German article (“der, die, das”).

Step 1: Material from day 1 and from repeat day 2 was tested after one week,

However, without any refresher material.

Step 2: The accusative of the German article (der, die, das) was introduced in orange (**den, masculine; die, feminine; das, neuter**) and in black and white (den, masculine; die, feminine; das, neuter) for the control group, in isolated concept.

Step 2: The list of masculine, feminine and neuter nouns with articles in the nominative case from day 1 was revisited, still in organized rows, in isolation, for a repeat overview, in color for the experimental group and in black and white for the control group.

Step 3: The same list of vocabulary rows was then introduced as study sheet with articles and nouns in the accusative case, in orange for the experimental group and in black and white for the control group.

Step 4: The next step was a task exercise. The subjects had to fill in the blanks in front of the nouns with the correct accusative case. The nouns appeared still in isolation, in the same rows and order according to gender, as the previous study sheets, in color for the experimental group and in black and white for the control group. However, the blank space with the nouns were color-coded in orange (below the masculine gender in blue, below the feminine gender in pink/red, and below the neuter gender in grey/black in the nominative case) for the experimental group; the same in black and white for gender in the nominative case and in black and white for the accusative case for the control group.

Step 5: After the task exercise, the articles in the accusative case in isolation were tested. The test sheet did not follow the pattern of the study and task sheets with organized rows of vocabulary according to gender, but now the words were mixed up, all appeared in black and white for the test, for both groups, the experimental and control group.

Step 6: The same accusative articles and their respective nouns were now presented in context within complete sentences as study and task exercises; the task was to highlight the

accusative case in orange for the experimental group and in black and white for the control group.

Step 7: Now the subjects had to fill in the accusative case. While the experimental group was given color clues as to the gender of the nouns, the control group had only black and white material.

Step 8: The final exercise was a test of the articles in the accusative case in context of complete sentences, according to the study and task sheets they had just completed.

Day 4: Tests from day 3 and repeat activities.

Step 1 to Step 7 was a repeat exercise of Step 2 to Step 8 of the previous day (on this day there was no post-test), again to find out how much was recognized and remembered after repeating the lessons from the previous day.

Day 5: Post test after one week, without any refresher material, and introduction of the accusative prepositions in context with the German article.

Step 1: Post test of the accusative cases of the German article, in isolation, after one week. No refresher material was offered for this test.

Step 2: Post test of the accusative cases of the German article, embedded in context of complete comprehensible sentences, after one week. No refresher material was offered for this test.

Step 3: Presentation of the accusative prepositions and as a refresher study activity, again revisiting of the accusative case of the German article, in color for the experimental group and in black and white for the control group.

Step 4: In continuation of the above activity, a task sheet, with articles and nouns in the nominative case, had to be filled out with articles in the accusative case, presented in

vocabulary rows of masculine, feminine and neuter articles and nouns, which were color coded to indicate masculine, feminine, and neuter gender, in color for the experimental group and in black and white for the control group. (This activity was presented as preparation for the following accusative prepositions exercises and tests).

Step 5: Study sheet with accusative prepositions and the corresponding accusative articles and their nouns, embedded in context with complete sentences. For the experimental group the articles and nouns were color-coded to indicate their gender, while the control group was presented with black and white grammar material.

Step 6: Subjects had the task to fill in the correct accusative article which were preceded by an accusative preposition, again the experimental group was provided with a color-coded clue as to the accusative preposition and the gender of the nouns, while the control group worked with black and white grammatical features, like the above study sheet, the accusative prepositions and articles with their respective nouns were presented in context with complete sentences.

Step 7: After the study and task activities, a test of the same material followed, the subjects had to fill in the correct accusative article for respective noun according to the preceding accusative preposition. All test material was presented in black and white for both groups.

Step 8: The accusative prepositions with the accusative articles and their nouns were further presented in vocabulary rows of masculine, feminine and neuter articles and nouns in the nominative and the accusative case in preparation for a story “Kati und Lasse gehen jeden Morgen Jogging”; in color for the experimental group and in black and white for the control group.

Step 9: Here a study and task sheet was presented in which the accusative prepositions and the accusative articles embedded in the above mentioned story, had to be highlighted in color for the experimental group and in pencil grey/black for the control group. This activity was in preparation of the following test.

Step 10: The test consisted of the same story as presented before. Subjects were asked to fill in the correct answers of the articles in the accusative case when preceded by an accusative preposition. All test material was in black and white, for the experimental group as well as for the control group.

Day 6:

Step 1 to Step 8: On this day, except for the two post tests, the presentation of all grammatical material and tests were a repetition from the day before. Again, with this procedure, the goal was to determine the influence of repetition for a possible improvement in performance and to what degree this might play out.

Day 7: Post tests and introduction of the dative case of the German article.

Step 1: Post test Nr. 1 (after one week) of the German article after accusative prepositions in context with complete sentences. As before, no refresher material was offered for post-test after one week.

Step 2: Post test Nr. 2 (after one week) of the accusative prepositions followed by the German article, embedded in complete sentences.

Step 3: Post test Nr. 3 (after one week) of the accusative article when preceded by the accusative prepositions, in context within a story “Kati und Lasse gehen jeden Morgen Jogging”.

Step 4: Presentation of the dative case of the German article (**dem, der, dem**) in color green for the experimental group and in black and white for the control group.

Step 5: Refresher study sheet with the German article in the nominative case and nouns, presented in vocabulary rows in isolation, in rows of masculine, feminine and neuter categories, in color for the experimental group and in black and white for the control group.

Step 6: The same articles and nouns were presented in the same format as a study sheet, only this time in the dative case, in color for the experimental group and in black and white for the control group.

Step 7: The same articles and nouns were presented in a task sheet in black and white for the subjects to highlight the dative articles and nouns, in color for the experimental group and in pencil grey/black for the control group.

Step 8: The same articles in the dative case were now presented in another study sheet, this time in context within a story “Birgit hat Geburtstag”.

Step 9: After these activities, a task sheet followed where the subjects had to highlight the dative case of the German article, in color for the experimental group and in pencil grey/black for the control group.

Step 10: After the preparation activities followed the test for the correct dative case of the German article for the masculine, feminine and neuter genders. The test sheets appeared in black and white for all subjects, experimental group and control group.

Day 8:

Step 1 to Step 7: On this day, the presentation of all grammatical material and tests were a repetition from the day before, day 7. Again, with this procedure, the goal was to determine

the influence of repetition after one day for a possible improvement in performance and to what degree this might play out.

Day 9: Post tests and introduction of the dative prepositions.

Step 1: Post test (after one week) of the dative case of the German article, in context of a story “Birgit hat Geburtstag.” The test was presented in black and white for all subjects, for the experimental as well as for the control group.

Step 2: The dative prepositions were introduced in context with complete sentences, in color (green) for the experimental group with color clues as to the gender of the nouns, and in black and white for the control group.

Step 3: The next step was for the subjects to work on a task sheet, they had to highlight the dative prepositions and the dative articles with nouns, in color for the experimental groups and in pencil grey/black for the control group. For the experimental group the genders appeared with colored clues and in black and white for the control group. The dative prepositions and articles with nouns were embedded in complete sentences, as they appeared in the study sheet.

Step 4: A test in the same format followed. Subjects had to fill in the correct dative case of the articles which were preceded by a dative preposition. The test appeared in black and white for all subjects, for the experimental group and the control group.

Step 5: Subjects were given a study sheet with rows of new vocabulary according to gender, articles and nouns in the nominative case as well as in the dative case of the masculine, feminine and neuter article gender. The experimental group received color clues as to gender of the articles whereas the control group was presented with material in black and white.

Step 6: The same material was presented in the same format as a task sheet where subjects had to fill in the correct dative case of the article. The gender of the nouns was color-coded for the experimental group and appeared in black and white for the control group.

Step 7: The previously studied vocabulary and grammar was now presented on a study sheet, embedded in context of a story “Ein Stadtbummel.” The dative prepositions and articles were color-coded for the experimental group and appeared in black and white for the control group. The experimental group received also color clues as to the gender of the nouns whereas the control group was treated only with black and white material.

Step 8: Next, subjects were asked to highlight the dative prepositions and the dative case of the articles and nouns embedded in the above story “Ein Stadtbummel,” in color for the experimental group and in pencil grey/black for the control group. Also for this task, the experimental group received color clues for the gender of the nouns whereas the control group was treated with black and white material.

Step 9: The same material as before was tested; subjects had to fill in the correct dative case of the masculine, feminine and neuter genders of the articles and nouns. All test material was presented in black and white, for the experimental group as well as for the control group.

Day 10:

Step 1 to Step 9: This day consisted of a repeat study, task and test activities, except for the post test “Birgit hat Geburtstag.” All grammatical material and tests were the same as the ones from the previous day, in color for the experimental groups and in black and white for the control group. Again, with this procedure, the goal was to determine the influence of repetition after one day for a possible improvement in performance and to what degree this might play out.

Day 11:

Step 1: Post test (after one week) of dative articles preceded by dative prepositions, presented in context of complete sentences. All test material was presented in black and white for both groups, for the experimental group and for the control group.

Step 2: Post test (after one week) of dative articles preceded by dative prepositions, embedded in complete sentences of a story “Ein Stadtbummel.”

Day 12: Comprehensive tests after four weeks of previous tests as follows:

1. The German article in the nominative case in isolated concept;
2. The German article in the nominative case embedded in the context of full sentences of a story “Ein Tag an der Ostsee in Deutschland;”
3. The German article in the accusative case, in isolated concept;
4. The German article in the accusative case, embedded in full sentences;
5. The German article in the accusative case in context with accusative prepositions embedded in full sentences.

Day 13: Comprehensive test after four weeks of previous tests:

1. Birgit hat Geburtstag,” dative case;
2. The German article in the dative case in context with dative prepositions, embedded in full sentences of a story “Ein Stadtbummel.”

Day 14:

Step 1: The GEFT Test was administered, under strict guidelines of the instructions.

Step 2: At the end of the experiment the students were asked to fill out an evaluation sheet (see Appendix N) what most of them were eager to do.

B. Day-by-Day Procedure of Experiment II (Experiment in Controlled Laboratory Environment of the Psychology 104 Class):

The procedure of Experiment II was conducted in the same basic design as in Experiment I, the same German grammatical features were presented and tested. However, the difference between the two experiment environments was in the testing intervals. While the Experiment I had four exposures of the German grammatical material with two test periods of one week and then four weeks, the Experiment II had only two exposures with one testing interval of one day.

The detailed description of the day-by-day procedure of Experiment II is shown in Appendix D, page 150.

CHAPTER VII: Results and Discussion for Analyses, incl. All Grammatical Categories:

The results of the experiment across experimental group (color vs. non-color), across the different grammatical cases, across times of exposure, and across gender of the nouns were calculated according to the percentages of the correct answers given. An analysis of variance statistical analysis (ANOVA) was run for this dependent variable across all four independent variables. When I report that a statistical analysis resulted in a statistically significant difference I mean that this mean difference reflects a p value of .05. This value means that we are utilizing a 95% confidence interval in our analyses.

A. Data from Experiment I, (the Natural Environment in the German 104 Class Room Study),

A. 1 . Study of Article and Noun in Context of Complete Sentences.

Section A1: Group main effects.

First, the results of the color experiment in the German language classes will be discussed, starting with the group variable, i.e., comparing the control with the experimental group as to how they performed overall.

Results: The data reveal a score of 77% correct answers for the control group and a score of 93% correct answers for the experimental group, i.e., the experimental group performed 16 % better than the control group, which indicates that color causes a 16% improvement for learning and memory of the presented German language materials, as shown in table A1 below.

Table A1: Experiment I, Group Main Effects

Comparison of Overall Performance of Both Groups, Control and Experiment

<u>Group</u>	<u>Percentage of correct answers</u>
Control	77%
Experimental	93%

Group main effect discussion: The data show that color has a positive influence on learning and memory of German grammatical forms (beyond the additional input enhancement of said grammatical categories in black boxes, a specific feature to make the grammar more salient, which both groups were exposed to). The positive influence of color was repeatedly confirmed by anecdotal statements. Students of the experimental group would verbally express to the experimenter how color made it easier for them to distinguish the different grammatical categories and remember them, and how they wished that German text books would follow the color example for their daily study of the German grammar.

Section A2a: Results of time of exposure for both groups (control and experimental).

Results: Looking across time of exposure for both groups together, the data show that time matters. The results reveal a statistically significant difference between the four different exposure days. On day one, 90% of the newly presented material was maintained; on day two, an exact repetition of the previous day's presentation (presentation of grammar material, study sheet, task exercise followed by a test), 94% of the second time presented material was maintained, a statistically significant 4 % improvement from day one. For the following two testing days no further opportunity was given to refresh subjects' memory with German grammar material. The data shows that after one week, only 80% of the previously presented test material was maintained, a 10% memory loss from day one and a 14% loss from day two. Finally, after four weeks, subjects remembered only 76% of the language material, which indicates a 14% memory loss from day one, and 18% memory loss from day two (which was a repeat day), and a 4% memory loss from day three, as shown in table A2a.

Table A2a: Experiment I, Results of Time of Exposure for Both Groups (Control and Experimental)

Both Groups	Day 1 (first exposure)	Day2 (repeat day)	Day 3 (after 1 week)	Day 4 (after 4 weeks)
Percentage of correct answers	90%	94%	80	76%

Discussion: These data are interesting with respect to reasonable expectations for students' memory capacity for German grammar elements/categories. Taking into consideration that both groups, control group and experimental group, were presented with enhanced grammar material plus the additional color enhancement for the experimental group, one could reasonably predict that these results reflect an above average performance (Rutherford & Sharwood Smith, 1988).

Section A2b: Results of time of exposure of overall grammatical features for both

groups separately.

A comparison between the control group and the experimental group.

Results: Looking at time of exposure separately for the control group and the experimental group is one of the main interests of this study. These data are shown in Table A2b below. On day one, the control group remembered 85% of the language material, on day two (again, a repetition day, i.e., a second time of exposure to the study, task and test material) 90% was maintained, a 5% improvement from the first to the second day. The knowledge retained after one week (again, no further opportunity was given to refresh subjects' memory with German grammar material) was 67%, and after four weeks 65% was retained; this difference between the third and the fourth exposure is statistically not significant. It shows, however, that after one week and four weeks a loss of 18% accuracy from day one and a loss of 24% accuracy from day two were recorded.

In contrast, on day one, the experimental group remembered 94% of the grammatical language material, on day two, 98% was maintained, a 4% improvement from the first to the second exposure. Here the improvement is statistically significant. After one week, 93% of the material was maintained, only a 1% accuracy loss from day one, and 5% accuracy loss from day two. After 4 weeks, 87% of the material was remembered, a loss of 6% accuracy from day one, and a loss of 11% accuracy from day two, and a 6% loss from day three. This was a reliable change, but is a far smaller change than observed for the control, the non-color group.

Table A2b: Experiment I, Time of Exposure of Overall Grammatical Features

A Comparison between the Control Group and the Experimental Group

Group	Day 1 (first exposure) (immediate recall)	Day 2 (repeat exposure) (immediate recall after rehearsal)	Day 3 (after 1 week) (no rehearsal)	Day 4 (after 4 weeks) (no rehearsal)
Control Group	85%	90%	67%*	65%*
Experimental Group	94%	98%	93%	87%

These data suggest that color has a significant influence on performance, on learning the material the first day of exposure as well as remembering it over a period of four weeks. This can be shown by the following comparisons: The experimental group has a lead of 9% accuracy over the control group on day one; and maybe even more significant is the comparison of the first exposure of the control group with an achievement score of 85%, with the fourth exposure (after four weeks) of the experimental group with an achievement score of 87%, which shows that the experimental group still performs as well as the control group after four weeks as the control group does on the first day of exposure of the grammatical categories.

Discussion of time effect: The above findings are significant and noteworthy. The different grammatical categories in general are better remembered when color enhancement makes them more salient to the learner, i.e., color had a significant effect on memory. The student does not only experience a better academic performance, one could speculate that it would also stimulate confidence in the student as well as make language learning a more enjoyable experience overall. These hypotheses were generated partly by the collected data as well as the anecdotal statements given to the experimenter in the classroom.

Section A3a: Testing of articles in nominative, accusative and dative cases for both groups.

Section A3b: Testing of articles in context with accusative and dative prepositions for both groups.

The individual grammatical categories which were tested, were the masculine, feminine and neuter articles with their respective nouns in the nominative, accusative and dative cases as well as in context with accusative and dative prepositions with the correct articles and their nouns.

Results: Looking across the exposure of the articles in different grammatical cases (articles in the nominative, accusative and dative cases) for both groups together, the data show no statistical difference for those three cases. These findings are shown in Table A3a.

In learning articles in context with accusative prepositions and dative prepositions, the data show a statistically significant difference of 5% between the two categories, as shown in table A3b. These data reveal a 5% lead by the articles in context with dative prepositions over the articles in context with accusative prepositions.

Further, with 79% and 84% accuracy respectively, the results indicate that there is a statistically significant increase in degree of difficulty for articles in context with prepositions over the previously discussed article case categories, as shown in table A3a and A3b. Here it needs to be noted that there is no statistical difference between the article in the accusative case and the article in context with dative prepositions, however, this has not been found for the nominative or the dative cases.

Table A3a: Experiment I, Articles in Three Different Grammatical Cases

for Both Groups Together.

Nominative	88%
Accusative	86% > (statistically same as 84% f. dat. prep.)
Dative	87%

Table A3b: Experiment I, Articles in Context with Accusative and Dative Prepositions

for Both Groups Together

Accusative Preposition	79%
Dative Preposition	84% >(statistically same as 86% for accusative)

Discussion: For language instructors it may prove helpful to know that the different grammatical cases require about the same amount of exposure for successful learning, so that equal time should be devoted to teaching the different article cases (nominative, accusative and dative) and their nouns. However, for the articles cases in context with accusative and dative prepositions, it suggests that these categories would require more exposure time for the same degree of accomplishment than for the previous categories.

Section A3c: Articles in grammatical cases and articles in context with prepositions

A comparison between the control group and the experimental group.

Looking across the exposure of the different grammatical cases separately for the control group and the experimental group, the data show a significant difference in performance of the two groups.

Results: First, looking at the control group's accuracy rate between the different case categories, the results show the highest score for the nominative case with 84% accuracy, followed by both the accusative case with 80% and the dative case with 77% accuracy. There is no statistically significant difference between the accusative and dative cases. The articles in context with prepositions show a significant drop in performance with 71% accuracy for the accusative case and 74% for the dative case, however, these data suggest that there is no significant difference between the preposition applications.

Second, looking at the experimental group's accuracy rate between the different case categories, the results show the highest score for the dative case with 97% accuracy, a significant increase of 4% over the nominative and the accusative case, both with 93% accuracy.

In the category of articles in context with prepositions, the dative case with 95% accuracy outperforms the accusative case with 87% accuracy by 8%, a significant difference. The data of the article in the dative case as well as in context with prepositions in the dative case show a lead of 3% and 8% respectively, indicating that for the experimental group the dative is the easiest to learn...

The main goal of this study is comparing the control group with the experimental group. Looking at the individual case categories, the data show significant differences in performance between the two groups. In the nominative case the experimental group outperforms the control group by 9%, in the accusative case the experimental group scores 13% higher than the control group, in the dative case the experimental group scores with a lead of 20% over the control group, in the category of articles in context with prepositions, the experimental group

out-performs the control group in the accusative case by 16%, and in the dative case by 21%, as shown in table A3c below.

Table A3c: Experiment I, Articles in Grammatical Cases and Articles in Context with Prepositions. A Comparison between the Control Group and the Experimental Group

	Nominative	Accusative	Dative	Acc.Preposition	Dat.Preposition
Control Group	84%	80%	77%	71%	74%
Experim.Group	93%	93%	97%	87%	95%

Discussion: The performance of the control group with a lead in the nominative case seems to meet traditional expectations, at least according to the experimenter's class room experience. Surprisingly, the performance of the experimental group seems, especially when looking at the article in the dative case as well as at the articles in context with dative prepositions, which have a lead of 4% and 2% respectively over all other categories and a lead of 20% and 21 % respectively over the performance of the control group. More light may be thrown at this finding after the discussion of the different article genders.

Section A3d: Control group time exposure across grammatical categories.

Results and discussion: Looking across time of exposure at the different case categories separately for the control group and the experimental group, the data show again that time is relevant.

On the first day of exposure, the control group scores in the nominative case 81% correct answers, in the accusative case in context with prepositions 82% and in the dative case in context with prepositions 85% correct answers. These results indicate that there is

statistically no significant difference in performance between these three case categories. The accusative case shows with 88% correct answers a statistical significant lead over the previously discussed case categories. The dative case scores with 91% correct answers, a lead of 3% over the accusative case, 10% over the nominative case, 9% over the accusative in context with prepositions and 6% over the dative case in context with prepositions.

On the second day of exposure (again, a repetition day, i.e., a second time of exposure to the study, task and test material) the control group scored higher than the first day across all grammatical categories, which was to be expected. The results in the nominative case with 92% correct answers, a 11% improvement over the previous day, in the accusative case with 92% correct answers, a 4% improvement over day one, in the dative case again with 92% correct answers, show no statistical difference from day one; in the grammatical category articles in context with accusative prepositions, the second day's score with 84% did not reveal a statistical significant improvement over day one; however, for the article in context with dative prepositions, 90% correct answers were recorded, a 5% improvement over day one.

At the third exposure, i.e., after one week, the control group's performance dropped significantly. Comparing the performance with day two (where all the material, the study, task and test material was presented for the second time), there was a 5% drop in the nominative case, a 22% drop in the accusative case, a 34% drop in the dative case, a 23% in the category article in context with accusative prepositions, and a drop of 30% in the category article in context with dative prepositions.

The retention of the German grammatical material was even lower after the fourth exposure, i.e., after four weeks. In the nominative case, the 76% correct answers indicate a drop of 16% from day two and a drop of 11% of day three; the accusative case experienced

with 69% correct answers a drop of 23%; however, the difference between the third and the fourth exposure was statistically not significant, that means that subjects performed after one week the same as after four weeks. In the grammatical category article in context with accusative prepositions, there was a difference in performance of 29% between the second and the fourth day of exposure, a drop from 84% to 55% correct answers. In this category, the difference between the third and the fourth day was 6%, a drop from 61% after one week to 55% after four weeks. In the category article in context with dative prepositions, a significant drop from day two with 90% correct answers to the fourth day with 61% answers, a decrease of performance of 29%. There is no statistical difference in performance between the third and the fourth exposure, i.e., the subjects scored the same after one week as after four weeks of exposure to the grammatical material, as shown in table A3d.

Table A3d: Experiment I, Time Exposure across All Five Grammatical Categories, for the Control Group

	Nominative	Accusative	Dative	Acc.Preposition	Dat.Preposition
Day 1	81%	88%	91%	82%	85%
Day 2	92%	92%	92%	84%	90%
Day 3	87%	70%	58%	61%	59%
Day 4	76%	69%	66%	55%	61%

Section A3e: Experimental group time exposure across five grammatical categories.

Looking across time of exposure at the different case categories for the experimental group, the data show that time is relevant; it also shows that color enhancement has a positive influence on the learning process and memory of German grammatical features.

Table A3e: Experiment I, Time Exposure across All Five Grammatical Categories, for the
Experimental Group

	Nominative	Accusative	Dative	Acc.Prepositions	Dat.Prepositions
Day 1 First Exposure	92%	95%	98%	91%	95%
Day 2 Repeat day	97%	97%	99%	96%	98%
Day 3 After 1 wk.	95%	92%	96%	86%	94%
Day 4 After 4 wks.	87%	86%	95%	75%	91%

Results: On the first day of exposure, the results of the article in the nominative case and the article in context with accusative preposition show statistically the same results with 92% and 91% correct answers. The accusative with 95%, the dative with 98% and articles in context with dative prepositions with 95% correct answers were statistically the same.

On the second day of exposure, the results across all five grammatical categories were statistically the same. Comparing these results with the first day, we see in the nominative case an improvement of 5% over the first day, in the accusative the score of 97% is only a marginal improvement over the first day with 95%; in the dative case, with 99% correct answers, no statistical improvement over the first day was recorded; whereas the dative case improved with 98% correct answers, 3% over the first day's performance.

On the third day of exposure, after one week, in the nominative case there was no statistically significant drop in performance from the second day. The accusative showed with 96% correct answers a drop of 5% from day two; for the dative case with 96% correct answers a drop of 3% from day two was recorded. The results for the article in context with accusative prepositions showed with 86% correct answers, a drop of 10% from day two, and for the article

in context with dative prepositions 94% correct answers were recorded a drop of 4% from day two.

On the fourth day of exposure, after four weeks, the scores across all five grammatical categories were relatively high. In the nominative 87% correct answers were recorded, a 10% drop from day two and a 7% drop from day three. In the accusative case, with 86% correct answers, a drop of 11% from day two and a drop of 6% from day three was recorded. Subjects scored in the dative case with 95% statistically 4% lower than on day two and statistically the same with 95% as day three. In the category article in context with accusative prepositions, the fourth day of exposure revealed 75% correct answers, a drop of 21% from day two and a drop of 11% from day three. In the category article in context with dative prepositions, data shows a score of 91% correct answers, a drop of 7% from day two; however, there is no statistical difference in the performance between day three (94%) and four (91%), as shown in table A3e. Comparison, clear overview, for the following discussion:

Table A3d: Experiment I, Time Exposure across All Five Grammatical Categories, Control Gr.

Table A3e: Experiment I, Time Exposure across All Five Grammatical Categories, Expmtl.Gr.

Comparison of Control Group (A3d) and Experimental Group (A3e).

		Nominative	Accusative	Dative	Acc.Preposition	Dat.Preposition
Day 1	A3d	81%	88%	91%	82%	85%
	A3e	92%	95%	98%	91%	95%
	Difference	11%	7%	7%	9%	10%
Day 2	A3d	92%	92%	92%	84%	90%
	A3e	97%	97%	99%	96%	98%
	Difference	5%	5%	7%	12%	8%
Day 3	A3d	87%	70%	58%	61%	59%
	A3e	95%	92%	96%	86%	94%
	Difference	8%	22%	38%	25%	35%
Day 4	A3d	76%	69%	66%	55%	61%
	A3e	87%	86%	95%	75%	91%
	Difference	11%	17%	29%	20%	30%

Discussion: These data show that time matters; students improve after repeating the German grammatical material, however, over time students lose a certain percentage of knowledge. Comparing the two groups, the control group and the experimental group, an interesting picture evolves. The experimental group, the “color” group, learns better on the first and second exposure, and also retains much more information on the third and fourth exposures than the control group. The experimental group scores higher on the first day of exposure than the control group on the second day of exposure, the second day being a complete repetition of the grammar presentation of day one, and thus, refreshes learning and memory which would foster higher test results. Further, it is noteworthy that the experimental group still performs better on day four, after four weeks, than the control group on the first day of exposure. These data indicate that color enhancement of the German grammar supports superior learning the material at the beginning as well as retaining knowledge better over time.

Section A4a: Results of overall study of the article genders for both groups together.

Results: Looking across the exposure of the different grammatical article genders, masculine, feminine and neuter, for both groups together, the data show a statistically significant lead by the feminine article with a performance rate of 88% correct answers over the masculine article with 84% and the neuter article with 83% correct answers.

Table A4a: Experiment I, Results of Overall Study of the Article Genders for Both Groups, Control Group and Experimental Group.

<u>Gender</u>	<u>Percentage of correct answers</u>
Masculine	84%
Feminine	88%
Neuter	83%

Discussion: The above record shows that the feminine case was easier to learn and to remember by 4% and 5% respectively than the masculine and the neuter articles. The masculine and the neuter articles show no statistical significant difference in accuracy, as illustrated in the table above. Why the feminine article seems to be easier to learn is not clear, however, an argument will be made in the conclusion of this dissertation.

Section A4b: Comparison of performance for the article genders (masculine, feminine, neuter) between the control group and the experimental group.

Results: Looking at both groups separately, the data show a clear advantage in performance by the experimental group over the control group, suggesting that color has a positive effect on performance. While both groups favor the feminine case (the experimental group only marginally equal to the masculine and neuter genders) and both groups perform statistically equal in the masculine and the neuter cases, the performance data reveal a 92% score for the masculine gender by the experimental group, a 16% lead over the control group, who scored only 76% correct answers in the masculine gender. A similar result could be registered for the feminine gender; the control group scored with 81%, while the experimental group scored with 95% correct answers, a lead of 14% over the control group. The neuter gender shows the biggest difference in performance between the two groups. Here the control group scored 74% and the experimental group 92%. The experimental group achieved a significant lead of 18% over the control group, as shown in table A4b, below:

Table A4b: Experiment I, Comparison of the Article Genders between the Two Groups

	Masculine	Feminine	Neuter
Control Group	76%	81%	74%
Experimental Group	92%	95% (marginally insignificant)	92%

Discussion: The data reveal that for the control group the feminine gender is easier to learn and remember than the masculine and the neuter genders. This seems surprising at first, however, considering that there are three masculine gender forms to remember (der, den, dem), while there are only two feminine gender forms (die, die, der), it could be plausible that the feminine gender scores highest. That leaves the comparison with the neuter gender where we find a similar situation in the gender forms as in the feminine, i.e., there are also only two gender forms to remember (das, das, dem). Here again, anecdotal statements given to the experimenter may throw some light on this issue. Students expressed verbally a general preference for the feminine gender without being able to give a specific reason.

For the experimental group no statistical difference between the genders was recorded. Color is making masculine gender and neuter gender as easy as feminine gender. An explanation might lie again in the finding that color matters. With color enhancement all grammatical features are noticed easier and are easier committed to memory.

Section A4c: All three genders (masculine, feminine, neuter) across the five different grammatical categories (nominative, accusative, dative, accusative prepositions, dative prepositions) for both groups together.

Results: Looking across all grammatical categories, the masculine, feminine, and neuter genders in their different cases, i.e., in the nominative, accusative and dative cases as well as in

context with the accusative and dative prepositions, the data reveals that the feminine gender is the easiest to learn among the three of the five categories. In the nominative case the feminine gender with 91% correct answers outperforms the masculine and neuter genders with 87% each by 4%. In the accusative case, the feminine again outperforms with 92% correct answers the masculine gender with 81% by 11%, and the feminine also outperforms the neuter gender with 85% correct answers by 7%. In the dative case the feminine and the masculine gender score statistically the same with 90% and 92% respectively. In this category (dative) the neuter gender scores 79% correct answers, a statistically significant drop of 11% from the feminine gender and 13% from the masculine gender. In context with accusative prepositions, the feminine article leads with 83% correct answers, compared to the masculine gender with 78% and to the neuter gender with 76%, a higher score by 5% and 7% respectively. Looking at genders in context with dative prepositions, the feminine and the masculine articles score the same with 82% correct answers while the neuter gender scores 87% and lead by 5% over the masculine and feminine genders.

Table A4c: Experiment I, All Three Genders across the Five Grammatical Categories for Both Groups Together, Control Group and Experimental Group.

	Nominative	Accusative	Dative	Acc.Preposition	Dat.Prepostion
Masculine	87%	81%	92%	78%	82%
Feminine	91%	92%	90%	83%	82%
Neuter	87%	85%	79%	76%	87%

Discussion: The data show students' overall higher performance results in the feminine case. Out of five grammatical categories, three of them (nominative, accusative and accusative prepositions) show the highest scores for the feminine gender; in two categories (dative and

dative prepositions) the feminine gender scores the same as the masculine. Only in one grammatical category and by only one gender case, are lower scores recorded for the feminine gender, i.e., the neuter in context with dative prepositions. According to these findings and in light of historical linguistic changes, one could speculate about a possible development for the future of the German article (Braun, 1993; Sick, 2007). In case that the German article of three genders should ever shrink to just one gender, it could possibly be the feminine gender that would prevail. Instead of the three articles “der, die das,” it could be reduced to “die” (which, incidentally, sounds more like the English “the” or perhaps like the Low German article “de”, a grammatical form for masculine and feminine combined). This is a somewhat wild speculation and due to Duden’s written grammar (Duden, 2000) most unlikely, however, not an impossible one.

Section A4d and A4e: All three genders (der, die, das) across the different grammatical categories (nominative, accusative, dative, in context with accusative and dative prepositions);
 Comparison between the control and the experimental group.

Since the focus of the experiment is a comparison of the learning and memory achievements between the control group and the experimental group, we now look at how both groups perform separately across gender across the different grammatical categories.

Results: First, we will look at the control group’s performance. This group performs better in the feminine gender in the nominative and the accusative case with a score of 88% correct answers each. In the nominative case, data show no significant difference between masculine with 82% and neuter with 83% correct answers. In the accusative case, neuter outperforms masculine by 8%, while in the dative case neuter drops to 63% correct answers,

19% lower than feminine and 22% lower than masculine. Feminine and masculine genders show the same statistical scores with 82% and 85% respectively. In the grammatical category gender in context with accusative prepositions, all three genders show a statistical equal result with masculine 68%, feminine 76% and neuter 67% correct answers. In the category gender in context with dative prepositions, masculine and feminine show the same result with 71% correct answers; here neuter outperforms masculine and feminine with 78%, a statistical significant lead of 7%, as shown in table A4d.

Table A4d: Experiment I, All Three Genders across the Different Grammatical Categories for the Control Group.

Control Gr.	Nominative	Accusative	Dative-	Acc.Preposition	Dat.Preposition
Masculine	82%	72%	85%	68%	71%
Feminine	88%	88%	82%	76%	71%
Neuter	83%	80%	63%	67%	78%

Secondly, we will look at the experimental group's performance. In the nominative case all three genders, masculine with 92%, feminine with 94% and neuter with 92% correct answers scored the same, these results show no statistical difference. The same holds true for the dative case with a 99% score for the masculine and the feminine genders and with a 94% score for the neuter gender as well as in the category of dative in context with prepositions, the masculine gender showed 94% correct answers, the feminine 93% and the neuter 97% answers which indicates no statistical difference between the three genders. The feminine gender leads with 97% correct answers in the accusative case with 6% over the masculine and neuter genders with 91% each. Also, in the category of articles in context with accusative

prepositions, the feminine gender shows a score of 90% correct answers and leads over the masculine with 87% by 3% and over the neuter with 84% by 6%.

The overall picture of the data shows that color makes all three genders comparatively easy to learn, it indicates that color has a positive effect on learning all three genders in their different grammatical categories, with the exception of two instances where the feminine results show higher scores than masculine and neuter, as shown in table A4e.

Table A4e: Experiment I, All Three Genders across the Different Grammatical Categories for the Experimental Group.

Experim.Gr.	Nominative	Accusative	Dative	Acc.Preposition	Dat.Preposition
Masculine	92%	91%	99%	87%	94%
Feminine	94%	97%	99%	90%	93%
Neuter	92%	91%	94%	84%	97%

Comparing the two tables A4d and A4e, the data reveal a significant difference in the performance of the two groups. The experimental group scored significantly higher across all grammatical categories than the control group.

In the nominative case, the data show for the masculine gender a 10% higher result by the experimental group than the results by the control group. Further, it shows a 12% lead by the experimental group for the feminine gender and a 10% lead for the neuter gender over the control group.

In the accusative case, the lead by the experimental group over the control group for the masculine was 19%, for the feminine 9% and for the neuter 11%.

In the dative case, the experimental group scored in the masculine and feminine genders 14% and 17% respectively higher, and in the neuter gender 31% higher.

In the category gender in context with accusative prepositions, the experimental group outperformed the control group with the masculine gender by 19%, with the feminine gender by 14%, and with the neuter gender by 17%.

In the category gender in context with dative prepositions, the experimental group outperformed the control group with the masculine gender by 23%, with the feminine gender by 22%, and with the neuter gender by 19%.

Discussion: These data indicate that color enhancement made the learning and memory of the grammatical features significantly easier. Apart from the fact that the experimental group performed with higher percentages of correct answers than the control group, the experimental group also scored more evenly across all genders and grammatical categories, suggesting that color makes the grammatical features more salient and easier to learn.

Section A5a: Control Group time exposure across all three article genders.

Results: On the first day of exposure, the masculine article with 85% correct answers, the feminine article with 86% correct answers, and the neuter with 85% correct answers are learned statistically at the same level.

On the second day, a repeat day, the masculine article scored with 91% correct answers, the feminine article scored also with 91% correct answers, whereas the neuter article scored with 88% correct answers, which indicates that all three genders are learned statistically at the same level.

On the third day, a test after one week, the masculine article registers with only 62% correct answers, whereas the feminine article shows a score of 72% correct answers, and the neuter article comes out with 67% correct answers.

On the fourth day, a test after 4 weeks, the correct answers for the masculine article lie by 65%, for the feminine article they lay by 74% correct answers, and for the neuter article the correct answers register 57%.

Table A5a: Experiment I, Time Exposure across All Three Article Genders for the
Control Group

	Masculine	Feminine	Neuter
Day 1	85%	86%	85%
Day 2	91%	91%	88%
Day 3	62%	72%	67%
Day 4	65%	74%	57%

Discussion: The data show that the control group performs statistically the same across three genders on the first and on the second day of exposure, on the third day of exposure, after one week, the feminine article shows a higher score over the masculine and the neuter article, a 10% and 5% increase respectively. After 4 weeks, the fourth exposure, the feminine article is clearly learned and remembered easier than the masculine and neuter articles. In this time category, the feminine article results in 9% higher than the masculine article and 14% higher than the neuter article. Here, again, the feminine article is recorded with a superior outcome, a result which should lead to further investigations and discussions (Sick, 2007).

Section A5b: Experimental Group time exposure across all three article genders.

Results: A similar pattern can be observed in the next study, for the experimental group: the data show no preference for any article in particular, until the fourth exposure; i.e., after four weeks the experimental group scores highest with the feminine article with 92% correct answers, a lead of 7% over the masculine article and a lead of 8% over the neuter article.

Table A5b: Experiment I, Time Exposure across All Three Article Genders, for the Experimental Group

	Masculine	Feminine	Neuter
Day 1	94%	95%	93%
Day 2	97%	98%	98%
Day 3	93%	94%	91%
Day 4	85%	92%	84%

Discussion: These data show that over time the feminine article is retained better than the masculine and neuter articles. These findings of better performance with the feminine article are consistent with anecdotal evidence given by subjects to the experimenter after presentation of the German grammatical texts; subjects could, however, not explain why they preferred the feminine article, they said it just felt better. Whether this phenomena is reflected in the native German speaking population is not clear, this might be an area of further investigation, maybe in the field of conversation analysis (CA) where often first linguistic changes are observed (Sick, 2007).

A. Data from Experiment I, continued.

A 2. Study of Articles and Nouns in Isolation (Non-Contextualized).

The results of the experiment across experimental group (color vs. non-color) across the application of article and nouns in isolation versus article and noun in context of sentences tested, were calculated according to the percentages of the correct answers given, under the same analysis as stated for the analysis for all grammatical categories in Chapter VII, p. 73.

Section A6: Articles and nouns in isolation, and

Articles and nouns in isolation versus articles and nouns in context with full sentences.

While the previous sections dealt with a study of articles in different grammatical categories embedded in sentences, the following sections will analyze the data derived from a study of German grammatical features presented in isolation, i.e., articles and nouns were presented as vocabulary list in long rows on a sheet of white paper; no reference to a meaningful sentence was given at this point. This was part of the total study.

Section A6: Group main effect.

This section will start with the group variable, again comparing the control group with the experimental group as to how they performed overall.

Results: For the control group the data show a score of 81% correct answers, and for the experimental group a score of 91% correct answers across the vocabulary tests, i.e., articles and nouns in isolation, as can be seen in table A6.

Table A6: Experiment I, Comparison of Overall Performance of Article and Noun in Isolation Between the Control Group and the Experimental Group.

Group	Percentage of correct answers
Control	81%
Experimental	91%

Discussion: According to these data, the experimental group outperformed the control group by 10%, suggesting that color enhancement has a significant effect on learning and memory of the presented German grammatical material. Further, comparing these data with the results of the data from section A.1 (group main effects of article and noun embedded in a text), table A1, it may be noteworthy that the control group scored 4% higher in the vocabulary test (above) than in the text/sentence test (below), while the experimental group scored statistically in both categories in the same range.

Experiment I, Comparison from Table A6, above.

Table A1(from Section A.1): Experiment I, Comparison of Overall Performance of Article and Noun Embedded in Text of Both Groups.

<u>Group</u>	<u>Percentage of correct answers</u>
<i>Control</i>	77%
<i>Experimental</i>	93%

This finding suggests that color enhancement makes the grammatical features in both categories salient enough to the student that there is no difference in learning and memorizing German grammatical features, whether it is grammar in isolation or grammar embedded in a text.

Section A7a: Results of time exposure for both groups – articles and nouns in isolation.

Results: Looking across time of exposure for both groups together, table A7a shows that time matters, and it shows a statistical difference between the three different exposure days. On the first day, 86% of the newly presented vocabulary was remembered, on the second day (an exact repetition of the previous day's study, task and test material), subjects scored 94%

correct answers, and at the third exposure, after an interval of four weeks, 78% of the vocabulary was remembered, a memory loss of 14%.

Table A7a: Experiment I, Time Exposure for Both Groups Together

Articles and Nouns in Isolation

Both Groups	Day 1 (first exposure)	Day2 (repeat day)	Day 3 (after 1 week)	Day 4 (after 4 weeks)
Percentage of correct answers	86%	94%	-	80%

Discussion: These data are especially interesting when comparing them with the time exposure for the article and noun in context as shown in table A2a, Section A.1, below. The results for the article in isolation are 4% lower than those of articles in context on the first day. On the second day, both grammar applications (in isolation and in context) come out with the exact same result, no superior performance of the one over the other. This application style was not tested after one week; after four weeks, however, the results show that the article in isolation comes out 4% higher than the article in context. This finding is somewhat surprising since recent German language pedagogues emphasize the importance for teaching new material in meaningful context and to avoid “old fashioned” rote learning of vocabulary for better learning results (Van Patten, 1996, Omaggio Hadley, 1993).

Experiment I, Comparison with Table A7a, above:

Table A2a (from Section A.1): Experiment I, Results of Time of Exposure for Both Groups
Articles and Nouns in Context

<i>Both Groups</i>	<i>Day 1 (first exposure)</i>	<i>Day2 (repeat day)</i>	<i>Day 3 (after 1 week)</i>	<i>Day 4 (after 4 weeks)</i>
<i>Percentage of correct answers</i>	<i>90%</i>	<i>94%</i>	<i>80</i>	<i>76%</i>

Section A7b: Results of time of exposure of overall grammatical features in isolation

A comparison between the control group and the experimental group.

Again, looking at time of exposure separately for the control group and the experimental group is one of the main interests of this study.

Results: As shown in table A7b below, the control group scores on the first day 81% correct answers, while the experimental group scores 90% correct answers, a 9% better achievement than the control group.

On the second day, the control group improves with 91% correct answers 10% over the first day. In comparison, the experimental group scores 96% correct answers, a 6% improvement over day one and it scores 5% higher than the control group.

On the third exposure, after four weeks, the control group drops its performance 20%, from 91% the second day to 71%. In comparison, the experimental group experiences a decline of only 8% between the second and the third exposure, i.e., after four weeks, the experimental group outperforms the control group by 17%, a significant statistical difference.

Table A7b: Experiment I, Time of Exposure of Overall Grammatical Features in Isolation.

A comparison Between Control Group and Experimental Group.

Group	Day 1 (First exposure)	Day 2 (Repeat exposure)	Day 3 (after 1 week – not tested)	Day 4 (after 4 weeks)
Control	81%	91%	-	71%
Experimental	90%	96%	-	88%

Discussion: Comparing the performance between the control group and the experimental group, the data indicate a superior test outcome of 17% for the experimental group. The experimental group scores higher on the first two days and retains much more of the

grammatical material over time than the control group. Further, it might be noted that the experimental group scores higher after four weeks (without refreshing their minds in the meantime) than the control group on the first day of exposure, suggesting that color makes a significant difference; it seems to promote learning as well as memory over some time.

With respect to article and noun in isolation versus article and noun in context (table A2b from Section A.1), a comparison reveals that on the first day, article and noun seem to be easier to learn when presented in context of a sentence; however, on the second exposure as well as on the third exposure both groups score statistically the same for both grammar applications.

Experiment Comparison with Table A7b, above.

Table A2b (from Section A.1): Results of time of exposure of overall grammatical features, in context

A comparison between the two groups.

<i>Group</i>	<i>Day 1 (first exposure)</i>	<i>Day 2 (repeat exposure)</i>	<i>Day 3 (after 1 week)</i>	<i>Day 4 (after 4 weeks)</i>
<i>Control Group</i>	85%	90%	67%*	65%*
<i>Experimental Group</i>	94%	98%	93%	87%

Section A8a: Overall results of article genders in isolation for the control group and the experimental group together.

Results: Looking across the exposure for the different article genders, masculine, feminine and neuter, in isolation, for both groups together, the data reveal a clear advantage for the feminine article with a score of 90% correct answers, a statistical lead of 5% over the masculine and the neuter articles, both of which show statistically the same results with 85% and 84% correct answers respectively, as shown in table A8a below.

Comparing the two grammar applications, article and noun in isolation and article and noun in context of a sentence, the data show that there is statistically no difference, as can be compared with data in table A4a (Section A.1) below.

Table A8a: Experiment I, Overall Results of Article Genders in Isolation, for Both Groups Together.

Gender	Percentage of correct answers
Masculine	85%
Feminine	90%
Neuter	84%

Experiment I, Comparison with Table A8a, above.

Table A4a (from Section A.1): Results of overall study of the article genders for both group, article and nouns in context – comparison table

<i>Gender</i>	<i>Percentage of correct answers</i>
<i>Masculine</i>	<i>84% *</i>
<i>Feminine</i>	<i>88%</i>
<i>Neuter</i>	<i>83% *</i>

Section A8b: Experiment I, Comparison between the Control Group and the Experimental Group across Article Gender and Noun in Isolation.

Results: In this category, the data record for the feminine article to result with the highest percentage of correct answers given by both groups, by the control group as well as by the experimental group, followed by the masculine and by the neuter gender; the results of which are statistically the same within each group. While this trend holds true for both groups, the data reveal a statistically significant difference in performance between them. Both groups

perform better the feminine article, however, the experimental group scored with 95% correct answers 10% above the control group who registered 85% correct answers. Also, in the masculine gender, the control group was outperformed by the experimental group, who scored with 90% correct answers 9% higher than the control group with 81% correct answers. In the neuter gender, the experimental group finished with an even higher difference in performance with 89% correct answers over 78% correct answers by the control group, an 11% better result.

Table A8b: Experiment I, Comparison between the Two Groups across Article Gender and Noun in Isolation

Group	Masculine	Feminine	Neuter
Control	81%	85%	78%
Experimental	90%	95%	89%

Experiment I, Comparison with Table A8b, above.

Table A4 (pg... from Section A.1.): Experiment I, Comparison of the Article Genders and Nouns in Context Between the Two Groups (Control and Experimental).

	<i>Masculine</i>	<i>Feminine</i>	<i>Neuter</i>
<i>Control Group</i>	76%	81%	74%*
<i>Experimental Group</i>	92%	95% (<i>marginally insignificant</i>)	92%

Discussion: The preference for the feminine article seems to be consistent for both groups. Comparing the results of the article and noun in isolation with those of the article and noun in context within a sentence, data reveal that for the control group the vocabulary in isolation worked slightly better, however, for the experimental group there is no statistical significant difference between the two applications; the experimental group learns and remembers equally well when presented with article and noun in isolation as when presented with the material in context.

That in itself would constitute a significant finding. It would suggest that color enhancement would make the grammatical features equally salient and impressionable in either application for learning and remembering them equally well.

Section A8c: Article genders in isolation across time for both groups.

Results: On the first day of exposure, the feminine and the masculine article receive statistically the same percentage of correct answers (87% and 86% respectively); the neuter gender trails with 83% correct answers by 4% and 3% respectively, as shown in table A8c.

On the second day of exposure, for all three article genders a significant improvement over the first day is recorded: the masculine article shows with 93% correct answers a 7% improvement over the previous day, as does the feminine article with 94% correct answers in comparison with 87% correct answers the previous day. Further, the results across all three genders are statistically the same.

On the third day of exposure, after four weeks, the feminine article is remembered best; with 94% correct answers it lies 12% higher than the masculine and 22% higher than the neuter gender. The memory loss over four weeks for the feminine article is only 6%, while there is 17% memory loss for the masculine article and even 19% memory loss for the neuter gender after four weeks.

Table A8c: Experiment I, Article Genders in Isolation across Time for Both Groups,
Control and Experimental.

	Masculine	Feminine	Neuter
Day 1 (first presentation)	86%	87%	83%
Day 2 (repeat presentation)	93%	94%	93%
Day 3 (after 1 wk. no repeat exercises)	-	-	-
Day 4 (after 4 weeks, no repeat exercises)	76%	88%	74%

Discussion: This data show that students learn all three article genders (der, die, das) equally well after the first and second exposure; however, over time the feminine article is retained better than the masculine and neuter gender. This might be an interesting finding for instructors who might think that the feminine gender in the dative (and genitive) case (both “der”) might easily be confused with the masculine article in the nominative case (“der”). This very well might be due to color-coding the German grammar. Students seem to understand that difference and remember it. Some subjects expressed anecdotal opinions to the experimenter to the effect that they would prefer the feminine gender; however, they could not explain why they felt that way. This might move us to consider that language learning may not be a purely mental exercise; other surrounding elements could have a certain influence on learning and memory. It just might be that for some people the higher frequency of “die” is more pleasing than the lower frequency of “der” and “das”. This proposition needs to be left to some possible future study in the appropriate field, an interesting and novel study it would be.

Section A9a: Test type article and noun in context versus article and noun in

Isolation; for the control group and the experimental group together.

Results: Data show that there is a reliable difference (marginal) between learning German grammatical features in context of meaningful sentences or in isolation as vocabulary lists. The overall results for the control group and the experimental group show that German grammar was better learned and remembered when presented in context within a sentence. The subjects scored with 88% correct answers 3% higher with the grammar in context compared to grammar in isolation where they achieved 85% correct answers, as shown in table A9a.

Table A9a: Experiment I, Test Type Article and Noun in Context versus Article and Noun in Isolation, for the Control Group and Experimental Group Together.

Test type	Percentage of correct answers
Article and noun in context	88%
Article and noun in isolation	85%

Discussion: These findings are in concert with the present-day teaching philosophy of main stream language researchers and instructors who advocate and present such methodologies or teaching approaches in teacher seminars. Consequently, today, instructors use primarily text books in accordance with “communicative language teaching”, where German grammar is taught in context of comprehensible and meaningful concepts (Wong, 2005; Omaggio Hadley, 1993; Oxford, 1990). In the Western world rote learning is considered outdated; in other countries, like Russia and China, however, it is still a desirable way to learn foreign languages (Wong, 2005).

Section A9b: Test type article and noun in context versus article and noun in isolation for the control group and the experimental separately.

Results: According to the findings in these data, the control group scored 83% correct answers when tested for the article and noun in isolation. When tested for the article and noun in context, the control group scored only 79% correct answers, which is statistically only a marginal difference from the previous day. For the experimental group, however, there is statistically no significant difference between the two applications for the German grammar, neither for the article and noun in isolation (a score of 92%) nor for the article and noun in context a score of 90%). The experimental group learned and remembered articles and noun in isolation just as easily as articles in context, as shown in table A9b.

Table A9b: Experiment I, Test Type Article and Noun in Context versus Article and Noun in Isolation for the Control Group and the Experimental Separately

Group	Articles/nouns in isolation	Articles/nouns in context
Control	83%	79%
Experimental	92%	90%

Discussion: For the experimental group it did not seem to matter whether the grammatical feature (article and noun) was presented in isolation or in context. The score was statistically the same in both applications, suggesting that color may play a significant role in the first stage of learning, i.e., in the noticing stage (Ellis, 1993), resulting in a better learning as well as better recall of the grammatical features.

In comparing the control group with the experimental group, the data show a significant gap between the performances of the two groups, in the category articles and nouns in isolation, the experimental group scored 9% higher, and in the category article and noun in context, the experimental group scored 11% higher than the control group. Here again, it seems evident

that color enhancement may play a significant role for better learning and memory of German grammar features.

Section A10a: Results of time of exposure of overall grammatical features for both applications, for article in isolation and article in context, for both groups together.

The data in table A10a (below) show that time of exposure matters significantly for article in isolation and article in context.

Results: On the first exposure, the results between the two applications are statistically significant, there is a 6% difference in the percentage of correct answers given, 83% for the article in isolation, and 89% for the article in context within a sentence which indicates that the grammar material is easier learned in context.

On the second exposure, there is still a difference between the two applications, the article in isolation records 93% correct answers while the article in context shows 95% correct answers, a difference of 2% in favor of the article in context.

On the third exposure, both article applications come out with the same result of 80% correct answers, the article in isolation as well as the article in context show no difference.

Table A10a: Experiment I, Time of Exposure of Overall Grammatical Features for Both Applications, for Article in Isolation and Article in Context, for Both Groups Together.

Time of exposure	Article in isolation	Article in context
1	83%	89%
2	93%	95%
3	80%	80%

Discussion: It is interesting to note that at the beginning it seems to be easier to learn and remember the German grammar features when embedded in a text than if presented in rows of just words in isolation, and that over time this tendency decreases until it eventually shows no preference over the one or the other. This might be an interesting factor to consider for the classroom, instructors might find that both applications may complement each other and one should not need to completely shy away from vocabulary learning.

Section A10b: Results of time of exposure of overall grammatical features for both applications, for article in isolation and article in context, for both groups separately.

Results: Control group: On the first day, the data record 78% correct answers in the category article and noun in isolation, and 85% correct answers in the category article and noun in context, a significant gain of 7% over the article in isolation.

On the second day, the records show 90% correct answers in the category article in isolation, and in the category article in context 93% correct answers, a 3% difference in favor for the application in context.

On the third exposure (after four weeks), there is statistically no difference in performance for both grammar applications with 70% and 73% respectively.

With respect to memory, in the category article and noun in isolation, the data show an improvement of 12% from day one to day two; however, there was memory loss of 20% over the course of four weeks, from 90% to 70%. In the category article and noun in context, the gain from day one with 85% correct answers over day two with 93% correct answers was 8%. After four weeks, only 73% of the knowledge was retained, a significant drop of 20% from the second exposure.

Experimental group: On the first day of exposure, the data show in the category article and noun in isolation 88% correct answers (10% higher performance than the control group) and 93% correct answers in the category article and noun in context which means that on the first day article and noun in context was 5% easier to learn than article and noun in isolation; a similar pattern as with the control group.

On the second day of exposure (a repeat exercise), the experimental group scores in the category article in isolation with 95% correct answers and in the category article and noun in context with 97% correct answers which signifies statistically the same result.

On the third exposure, which was after four weeks, there was no statistically significant difference in performance between the two applications. For the article and noun in isolation 89% correct answers were recorded, and for the article and noun in context 86% correct answers were recorded, these results are statistically the same.

Table A10b: Experiment I, Time of Exposure of Overall Grammatical Features, for Article in Isolation and for Article in Context, for Both Groups Separately

Group	Exposure	Article in isolation	Article in context
Control	1	78%	85%
	2	90%	93%
	3	70%	73%
Experimental	1	88%	93%
	2	95%	97%
	3	89%	86%

Discussion: The data above show an interesting result; both groups demonstrate at first a better performance with the article and noun in context, a tendency which over time

diminishes to the point that it does not matter whether the German grammar features are presented in isolation or in context. Even though both groups show the same learning patterns with respect to article and noun in isolation and articles and noun in context, it is clear that color matters; the experimental group scores significantly higher across all three exposure days in both applications. It is noteworthy that the experimental group performs after four weeks statistically the same as the control group on the first day of exposure

3. Group Embedded Figures Test (GEFT):

The Group Embedded Figures Test did not have the predicted effect. No difference in performance between the two learning styles could be measured. Both, the field dependent and the field independent learners remembered the German grammatical features at the same level.

B. Experiment II (Controlled laboratory study in the Psychology Department).

As mentioned before in the “method section”, the laboratory experiment was conducted over a period of three consecutive days, for approx. 55 minutes each, there was no repeat exercise. The German grammar material was presented on the first day with study and task material and tested at the end of the first period. Then it was retested the next day without any repeat exercises beforehand. No long-term memory test was possible. However, all German grammatical categories were covered in the same way as administered to the natural class room experiment in the German department, i.e., group main effect (control versus experimental group), the masculine, feminine and neuter article genders (der, die, das) with their respective nouns in the nominative, accusative and dative cases as well as in context with accusative and dative prepositions with the correct answers and their nouns, across grammatical categories and time exposure. Also, the application of German grammatical material was administered in context within a text and in isolation.

B. 1. Study of article and noun in context, Experiment II, (controlled laboratory).

Section B1: Group main effects.

This section deals with the results of the color experiment in the laboratory environment, in the psychology department, starting with the group variable, i.e., comparing the control group with the experimental group as to how each group performed overall.

Results: The data reveal a score of 76% correct answers for the control group and a score of 89% correct answers for the experimental group; this means that the experimental group performed 13% better than the control group, as shown in table B1.

Table B1: Experiment II, Laboratory Environment,

Group Main Effects

Comparison of Overall Performance of Both Groups

Group	Percentage of correct answers
Control	76%
Experimental	89%

Discussion of group main effect: The significant difference in performance between the two groups suggests that color has a positive influence on learning and memory of German grammar material (beyond the input enhancement for all grammatical forms in black boxes, an enhancement feature to enable the student to focus on the grammatical forms, which both groups were exposed to).

Section B2a: Results of time exposure for the control group and the experimental group together.

The data posted in the table B2a reveal the overall retention level from the first day of exposure and then from the second day, one day after the first exposure.

Results: Both groups together score on the first day 88% correct answers, and on the second day 77% correct answers, an 11% reduction in accuracy. In other words, after one day 11% of knowledge was lost.

Table B2a: Experiment II, Time Exposure for Both Groups Together

Both Groups	Day 1 (first exposure with test)	Day 2 (just test repeat after 1 day)
Percentage of correct answers	88%	77%

Discussion: Here the focus is on how much of the German grammatical forms are remembered after one day, of material consisting of a relatively large amount of information to subjects who had never been exposed to the German language. 88% of the material was retained in this overall study after only one study session on the same day of about 40 minutes exposure. Then, on the next day, without any further repetition of the previous grammatical material, 77% of the grammatical material was retained. The data show that the performance declined by 11 %. The experimenter would argue that these results would be considered a very satisfactory outcome for a regular German language class.

Section B2b: Results of time of exposure of overall grammatical features

A comparison between the control group and the experimental group.

Again, comparing the two groups, the control group (color) and the experimental group (black and white), as they perform separately is one of the main interests of this experiment.

Results: As the data show, the control group scores on the first day 84% correct answers and on the second day 68% correct answers, a reduction in accuracy of 16% after one day. The

experimental group achieves on the first day an accuracy rate of 92%, which is followed on the second day with an accuracy rate of 86%. The experimental group drops its accuracy rate by 6% after one day, as shown in table B2b.

Table B2b: Experiment II, Time of Exposure of Overall Grammatical Features

A Comparison between the Control Group and the Experimental Group

Group	Day 1 (first exposure, with test)	Day 2 (test after day 1)
Control group	84%	68%
Experimental group	92%	86%

Discussion of time exposure of overall grammatical features for both groups separately:

Looking at time of exposure, both groups declined in their performance after one day which is to be expected. What is noteworthy is the degree of decline between the two groups. The knowledge retained after one day was 10% higher for the experimental group than for the control group, suggesting that color made the difference for the experimental group to learn and remember better. Further, on the first test, the experimental group scored 8% higher than the control group, and a day later the results show an 18% better performance by the experimental group over the control group. The most significant observation reflected on table B2b is, that the experimental group performed on the second day statistically as well as the control group did on the first day. These results indicate that color enhancement of the German grammatical forms has a significant influence on learning and memory.

Section B3a: Testing of articles in the nominative, accusative and dative cases for both groups together.

Section B3b: Testing of articles in context with accusative and dative prepositions for both groups together

Just as in the class room study, so were the articles in different grammatical categories tested in the laboratory study; the masculine, feminine and neuter article genders (der, die, das) with their respective nouns in the nominative, accusative and dative cases as well as in context with accusative and dative prepositions.

Results: The data show that the nominative case with 79% correct answers was harder to learn than the accusative case for which 84% correct answers were recorded; and the dative case with 89% correct answers was clearly the easiest to learn and remember, as shown in table B3a.

Table B3a: Experiment II, Articles in Three Different Grammatical Cases for Both Groups

Together, the Control Group and the Experimental Group

Nominative	79%
Accusative	84%
Dative	89%

In looking at articles in context with accusative prepositions with 74% accuracy, and articles in context with dative prepositions with 86% accuracy, the data reveal a statistically significant difference of 12% between the two categories, as shown in table B3b.

Table B3b: Experiment II, Articles in Context with Accusative and Dative Prepositions for

Both Groups Together

Accusative prepositions	74%
Dative prepositions	86%

Discussion: The data of overall grammatical categories show that the dative case and the dative case in context with prepositions was easiest to learn, followed by the accusative and then nominative; the accusative in context with prepositions was the hardest to learn and remember.

These findings would indicate that the German grammatical forms are relatively easy to learn; subjects with just two days of exposure of the grammar material grasped the concept of the three article gender system as well as its use in different grammatical case system. The color-coding of the grammatical features may have contributed to these findings.

Section B3c: Articles in grammatical cases and articles in context with prepositions

A comparison between the control group and the experimental group

Looking across the exposure of the different grammatical cases separately for the control group and the experimental group, we find a statistically significant difference in performance between the two groups.

Results: First, looking at the control group's performance of the different case categories, we find the highest score was achieved for the dative case with 83% and the accusative case with 79% correct answers, both results are statistically the same. The correct answers given for the nominative case is recorded with 74% and for the dative case in context with prepositions with 76 %, both percentages fall into the same range and are statistically the same. While the results for the nominative case and the dative case in context with prepositions are statistically the same, the accusative in context with preposition falls below all other grammatical categories. The data record a 15% drop from the dative case and a 11% drop from the accusative case, an 8% drop from the dative case in context with prepositions and a 6% drop from the nominative case.

Second, looking at the experimental group's accuracy rate across the different case categories, the results show the highest scores for the dative case with 95% correct answers and for the dative case in context with prepositions with 95% correct answers, a significantly higher achievement over the accusative case with 88% accuracy and over the nominative case with 85% accuracy (both fall into the same statistical range and signify the same) as well as over the accusative case in context with prepositions with 80% accuracy.

Looking at the individual case categories, the data reveal significant differences in performance between the two groups. While both groups excel in the dative case, the experimental group scores 12% higher than the control group. In the category dative case in context with prepositions, the experimental group also scored with 95% accuracy and outperformed the control group by 19%. In the accusative case the experimental group outperformed the control group by 9%, and in the nominative case the difference was 6% in favor of the experimental group, as shown in table B3c.

Table B3c: Experiment II, Articles in Grammatical Cases and Articles in Context with Prepositions

A comparison between the control group and the experimental group.

	Nominative	Accusative	Dative	Acc.Preposition	Dat.Preposition
Control	74%	79%	83%	68%	76%
Experimental	85%	88%	95%	80%	95%

Discussion: Comparing the results of the control group and the experimental group remains the main goal of this study. While both groups follow a similar pattern in achieving the results for the different grammatical categories, the data show that the experimental group

scored significantly higher than the control group in all categories. Both groups scored highest in the dative case and lowest in the accusative case in context with prepositions; however, in these two categories, the experimental group outperformed the control group by 12% and 11% respectively. These overall results would lead us to conclude that color matters; that it was the color enhancement of the grammatical features that made it easier for the experimental subjects to learn and remember the material, while the control group was only exposed to black and white grammar material which did not create the attention and focus to better learning and memory.

Section B3d: Time exposure across all five grammatical categories.

A comparison between the control group and the experimental group.

Results: On the first day of exposure, across all five grammatical categories, the control group scored 77% in the nominative, 87% in the accusative and 93% in the dative cases, in the category article in context with accusative prepositions, the control group scored 76% and in context with the dative prepositions they scored with 88% correct answers. After one day, without, any refresher exercises, the control group had forgotten substantially: they scored in the nominative case 72% correct answers, a 5% drop from the previous day, in the accusative they scored 72% correct answers, a drop of 15% from the day before; the dative case was registered with 72% correct answers, which indicates a drop of 20% in memory loss over the previous day; however, there was no statistical difference between these three cases on the second day of testing. In the category article in context with accusative prepositions, the data for the control group showed 59% correct answers on the second day, which indicates a memory loss of 17%. In the category article in context with dative prepositions, the control group scored on the second day 64% correct answers, which reveals a drop in performance of

24% from the first exposure, the previous day. The results for articles with accusative prepositions as well as with dative repositions were statistically the same.

On the first day of exposure and testing, the experimental group scored in the category article in the nominative case 85% correct answers, in the accusative case 93% and in the dative case 98% correct answers. In the category article in context with accusative prepositions, they scored on the first day 85% correct answers, and with dative prepositions 98% correct answers.

On the second day, i.e., after one day, they scored in the nominative case 84% correct answers, statistically no difference from the first day with 85% correct answers. In the accusative case they scored 83%, a 10% drop from the day before. The test for the dative case revealed a score of 92% correct answers, a 6% drop from the day before. In the categories article in context with accusative prepositions, the data show a score of 76% correct answers, and with dative prepositions a score of 93% correct answers, which indicates a drop in performance of 9% and 6% respectively.

Table B3d: Experiment II, Time Exposure Across All Five Grammatical Categories.

A Comparison between Control Group and Experimental Group.

<u>Day</u>	<u>Group</u>	<u>Nominative</u>	<u>Accusative</u>	<u>Dative</u>	<u>Acc.Prepos.</u>	<u>Dat.Prepos.</u>
Day 1	Control	77%	87%	93%	76%	88%
Day 1	Experimental	85%	93%	98%	85%	98%
Day 2	Control	72%	72%	73%	59%	64%
Day 2	Experimental	84%	83%	92%	76%	93%

Discussion: Looking at the data in table B3d, it is obvious that both groups, the control group as well as the experimental group, perform within their group, with similar results across the five grammatical categories. The article in the dative case is the easiest to learn, followed by the dative with dative prepositions. The article in the accusative case comes in as third hardest to learn, whereas the article in the nominative case as well as the article in context with accusative prepositions are the hardest to learn and to remember. It is interesting to note that both groups experience the same degree of difficulty for the same grammatical categories. The difference in performance between the two groups comes in when we 1) compare the performance on the first day and 2) compare the loss in memory on the second, after one day, and 3) when we compare the performance of the experimental group on the first day with the performance of the control group on the second day. For a better overview, the following figure is presented: The experimental group outperformed the control group in all five grammatical categories with the following percentages on the first day and the second day:

- 1) Comparison of performance on the first day, the experimental group outperformed the control group by the following percentages:

Table B3e. 1) Experiment II, Comparison of Performance on the First Day.

The Experimental Group Outperformed the Control Group by the following Percentages:

Expreim.Group outperforms:		Nominative	Accusative	Dative	Acc.Prepos.	Dat.Prepos.
Better performance:	on Day 1	by 8%	by 6%	by 6%	by 9%	by 10%
Better performance:	on Day 2	by 12%	by 11%	by 19%	by 17%	by 29%

- 2) Comparison between the two groups, of loss of memory from one day to the next, The experimental group forgot much less than the control group which is demonstrated

in the following table B3f:

Table B3f. 2) Experiment II, Comparison of Memory Loss between the Two Groups

	After one day	Nominative	Accusative	Dative	Acc.Prepos.	DativePrepos.
Control group	Memory loss	5%	15%	20%	17%	24%
Experimental group	Memory loss	1% <i>(statistical insignificant)</i>	10%	6%	9%	6%

These results show a significant difference in memory performance between the two groups. The experimental group clearly remembered the German grammatical feature much better after one day than the control group. In fact, for the experimental group the performance on the first day (85%) and on the second day (84%) is statistically the same. This shows that the color-coded grammatical material helped the subjects not only perform better on the first day, but also triggered the retrieval mechanisms for much better memory on the second day.

3) Comparison of the performance of the experimental group on the first day with the performance of the control group on the second day (again, a table can give a better impression):

Table B3g. 3): Experiment II, Comparison between First Day of Control Group and Second Day with Experimental Group.

	Scores on:	Nominative	Accusative	Dative	Acc.Prepos.	DativePrepos.
Control group	Day 1 <u>Directly</u> after exposure	77%	87%	93%	76%	88%
Experimental group	Day 2 <u>after one day</u> of exposure	84%	83%	92%	76%	93%

This table shows clearly that the experimental group performed even better on the second day (with exception of the article in the accusative case), after one day of exposure than the control group did on the first day, right after exposure. The scores for the article in the dative case are statistically the same for both groups. These results suggest overwhelmingly that the color-coded German grammatical features are better learned and remembered than the grammatical material in black and white.

Section B4a: Results of overall study of the article genders for both groups together.

Results: Looking across the exposure of the different grammatical article genders, masculine, feminine and neuter, for both groups together, the data reveals that there is no statistical difference between the three genders; the scores of correct answers with 83% and 81% are statistical the same.

Table B4a: Experiment II, Overall Study of the Article Genders for Both Groups Together.

<u>Gender</u>	<u>Percentage of correct answers</u>
Masculine	83%
Feminine	83%
Neuter	81%

Discussion: According to these data, both groups in the laboratory experiment performed the same across all three articles genders. A comparison with the data from the class room experiment reveals a different result: for subjects in that environment the feminine case was easier to learn and remember by 4% and 5% respectively than the masculine and the neuter articles, as shown in *table A4a* below:

*Table A4a: Experiment I, Results of Overall Study of the Article Genders for Both Groups.
Example from the class room experiment*

<u>Gender</u>	<u>Percentage of correct answers</u>
<i>Masculine</i>	84%
<i>Feminine</i>	88%
<i>Neuter</i>	83%

Section B4b: Comparison of performance of the article genders (masculine, feminine, neuter) between the control group and the experimental group.

Results: Looking across the article genders for the control group as well as for the experimental group, the data reveal that for both groups separately all three genders to be in the same range. For the control group, masculine with 76% accuracy, feminine with 78% accuracy and neuter with 74% accuracy show statistically no difference, which means that no one particular gender sticks out, all three genders' degree of difficulty was the same.

The same pattern was recorded for the experimental group who did not favor one particular gender, as previously experienced. Masculine with 89% accuracy, feminine with 89% and neuter with 86% accuracy do not indicate any statistical difference. All three genders were learned and remembered at the same rate, as shown in table B4b.

Table B4b: Experiment II, Comparison of Performance of the Article Genders (masculine, feminine, neuter) Between the Control Group and the Experimental Group.

<u>Group</u>	Masculine	Feminine	Neuter
Control	76%	78%	74%
Experimental	89%	89%	86%

Discussion: It is interesting to note that for both groups, gender did not matter; gender did not have an effect in the laboratory study. However, the experimental group outperformed the control group in all three genders, suggesting that color made the German grammatical features more salient for better noticing, learning and remembering them.

B.2. Experiment II, (Controlled Laboratory Study in the Psychology Department), cont.

B.2. Articles and Nouns in Isolation, and

Articles and Nouns in Isolation versus Articles and Nouns in Context with Full Sentences.

While the previous sections dealt with a study of articles in different grammatical categories embedded in sentences, the following sections will analyze the data derived from a study of German grammatical features presented in isolation, i.e., articles and nouns were presented as vocabulary in long rows on a sheet of white paper; no reference to a meaningful sentence was given at this point. This was part of the total study.

Section B5: Group main effect, articles and nouns in isolation

This section will start with the group variable, again comparing the control group with the experimental group as to how they performed overall, which is the main focus on this study.

Results: For the control group the data show a score of 75% correct answers, and for the experimental group a score of 86% correct answers across the vocabulary tests, i.e., articles and nouns in isolation, as can be seen in table B5.

Table B5: Experiment II, Group Main Effect, Articles and Nouns in Isolation

Group	Percentage of correct answers
Control	75%
Experimental	86%

Discussion of group main effects in isolation: As these data show, the experimental group scored 11% higher than the control group, suggesting that color had a significant influence on the learning process of the subject. Comparing the grammar application article and noun in isolation (table B5 above) with the application article and noun in context of complete sentences (table A.1 below), the data show that there is no effect, the results for the control group as well as for the experimental groups are statistically the same.

*Comparison Table A.1: Experiment I, Group Main Effects, Articles and Nouns in Context within Complete Sentences.
Comparison of Overall Performance of Grammatical Features in Context Both Groups.*

<i>Group</i>	<i>Percentage of correct answers</i>
<i>Control</i>	<i>76%</i>
<i>Experimental</i>	<i>89%</i>

Whenever we find results like these, where there is no significant difference between the two grammar applications, it gives us an uneasy feeling, because contemporary researchers in applied linguistics have determined that learning grammatical features in context of comprehensible sentences proves to be more successful than grammar learning in isolation, i.e., rote learning of long lists of vocabulary as practiced in the Grammar methodology for hundreds of years. This is discussed earlier in this dissertation; see pages 3, 17, 24.

Section B6: Overall results comparing article in isolation versus article in context for both groups together.

Results: With scores of 80% correct answers, when vocabulary was presented in isolation and with scores of 81% correct answers, when the German grammatical features were embedded in sentences, the data show no statistical difference between the two categories, i.e.,

learning German grammatical features in context of complete sentences or in isolation as vocabulary lists, as shown in table B6.

Table B6: Experiment II, Overall Results Comparing

Article in Isolation versus Article in Context

Test type	Percentage of correct answers
Article in isolation	80%
Article in context	81%

Discussion: The results of this study section seems incongruent with to-day's favored strategies in teaching second languages, where the general opinion, based on research (Van Patten, 1996), is that grammatical material is easier learned when presented in understandable and meaningful sentence concepts (Wong, 2005). This experiment seems to indicate that there is room for learning some grammatical features in isolation and not exclusively in context of full sentences.

Section B7: Results of time exposure across article in isolation versus article in context for the control group and the experimental group together.

Results: For the article and noun in isolation, the data show with 79% correct answers on the first day and with 80% correct answers on the second day, no statistical difference between the times of exposure. For the article and noun in context within sentences the data show quite a different result. With 85% correct answers on the first day and with only 78% correct answers on the second day, the data reveal a difference of 7% between the two exposure days.

Table B7: Experiment II, Time Exposure across Article in Isolation versus Article in Context
For the Control Group and the Experimental Group Together.

Test type	Day 1	Day 2
Article in isolation	79%	80%
Article in context	85%	78%

Discussion: The results of this study are interesting as we see from the data that there is no statistical difference between the first and the second day of exposure for the article in isolation, that are articles with their nouns in the masculine, feminine and neuter gender presented in rows of vocabulary (as practiced in the Grammar-Translation method). This means that after one day, the subjects remembered statistically the same amount of vocabulary as after immediate exposure on the first day. In contrast, when the same vocabulary was presented in context of full sentences, we see a higher retention level on the first day of exposure; however, data show that the retention level drops considerably on the second day. This might indicate that students may learn the German grammatical features embedded in sentences rather well on the first day of study, however, do not remember them as easily after one day of such exposure. This finding is surprising; however, it is interesting with respect to teaching German grammar. Teaching grammatical material in isolation might have certain benefits.

Section B8: Results across test types for control group and experimental group separately.

Results: The data reveal 73% correct answers for articles and nouns in isolation and 76% correct answers for the same grammatical features presented in context within full sentences. In statistical terms there is no difference between the two applications.

The data for the experimental group show 86% correct answers in the application of isolated articles and nouns and 87% correct answers in the application of articles and nouns in context within meaningful sentences. According to this data, there is no statistical difference between the two applications, article and noun in isolation and article and noun in context of meaningful sentences.

Table B8: Experiment II, Test Types for Control Group and Experimental Group Separately.

Group	Article in isolation	Article in context
Control	73%	76%
Experimental	86%	87%

Discussion: In this study section the data indicate that it does not matter whether students are presented with new German grammatical material in isolation or in context within full sentences. These results can be observed for both groups, the control group and the experimental group. However, when comparing the two groups with each other, it becomes obvious that the experimental group outperforms the control group in both applications by an average of 12%. This, again, might be attributed to the positive influence of color which makes the German grammatical features more salient, thus, it might cause better noticing and attention and enhances recall and memory.

Section B9: Results across time exposure for both test types for the control group and the experimental group separately.

Results: Control group: In this study two concepts of two different grammar presentation methods was tested. First, articles and nouns in isolation, i.e., in long vocabulary rows. Second, the same articles and nouns were presented embedded in full sentences.

The data show that on the first day of exposure, the control group scored with 72% correct answers in the method articles and nouns in isolation; and in the method articles and nouns embedded in a text, they scored 81%. On the second day, the control group scored with 75% correct answers in the first method (isolation) and in the second method (embedded in a text) they scored 71% correct answers.

Experimental group: On the first day, the experimental group scored with the method article and nouns in isolation with 87% correct answers, and with the method articles and nouns embedded in a text, they achieved 89% correct answers. On the second day, the experimental group scored with the material in isolation 85% correct answers, and with the material embedded in a text, they achieved 84% correct answers.

Table B9: Experiment II, Time Exposure for Both Test Types for the

Control Group and the Experimental Group Separately.

Group	Day	Art.isolation	Art.context	Day	Art.isolation	Art.context
Control	Day 1	72%	81%	Day 2	75%	71%
Experimental	Day 1	87%	89%	Day 2	85%	84%

Discussion: The above data show that the control group favors on the first day of exposure, the method of teaching vocabulary in context within full sentences. The results show an advantage of 11% over the method of teaching vocabulary in isolation. This trend is supported by to-day's teaching methodologies (Omaggio Hadley, 1993). On the second day of testing, no statistical difference between the two methods could be measured.

The experimental group did not demonstrate any superior result over any particular method; statistically they performed on the first day the same with either method, article and

noun in isolation or article and noun embedded in full sentences. On the second day of testing, they performed statistically the same as day one. This finding is significant; it suggests that color made the German grammatical features so salient and noticeable that it did not matter with which method (in isolation or in context) the grammatical features were presented. Here again, the test reveals that there could be value in teaching certain German grammatical features in isolation. Besides articles and nouns, especially accusative and dative prepositions as well as certain verbs which call for the accusative and the dative case, could be considered suitable grammatical material for application in isolation.

B. 3. Results of the Group Embedded Figures Test (GEFT):

The Group Embedded Figures Test (GEFT) did not have the predicted effect. No difference in performance between the two learning styles could be measured. Both, the field dependent and the field independent learners remembered the German grammatical features at the same level.

CHAPTER VIII: Conclusion.

The goal of this research project is to find out whether or not color coding has an effect on second language acquisition, in particular on learning German grammatical features, by using neurocognitive theory to develop a new approach for teaching German grammar. The experiment was conducted in two separate environments, one in a natural setting of a normal beginner's German class in the German Department (Experiment I), and the other one in a controlled laboratory setting in the Psychology Department (Experiment II) at the University of Kansas. The overall results of the collected data reveal a statistical significant advantage of color over black-and-white instructional material, with a 16% overall superior performance by

the experimental group over the control group in Experiment I, and with a 13% overall better performance by the experimental group over the control group in Experiment II.

These results show that color matters, that color has a clear advantage over black and white. It can be assumed that color enhancement of certain linguistic features supports learning, memory and retrieval of German grammar.

The main goal of this study is to compare the control group (black and white grammatical features) with the experimental group (color-coded grammatical features). While the overall data of both experiment environments, Experiment I and Experiment II, show converging results, some of the findings will have to be discussed separately. This applies to the study of time exposure because the Experimental I group was tested after one week, and then after four weeks of the first exposure, while the Experiment II group was tested one day after the first exposure of the grammatical material.

Time Exposure: First, we will discuss the study of time exposure for Experiment I. When looking at the time of exposure of overall grammatical features separately for both groups (control and experimental), the data show that time matters (Table A2b, p. 77); at first, students improve after repeating the German grammatical features after one day (repeat day); but over time, after one week and then after four weeks students lose a certain percentage of knowledge, which is to be expected. However, the interesting question remains as to how much knowledge is forgotten. When comparing the two groups, the results on the first day of exposure show that the experimental group (color) performed 9% better than the control group (black and white); and that the experimental group still performed as well after four weeks (with 87% correct answers) as did the control group on the first day (with 85% correct answers); a further comparison of performance between the two groups after four weeks

resulted in a 22% advantage for the experimental group (color) over the control group (black and white) who scored 65% correct answers after four weeks.

Secondly, the results of time exposure of Experiment II will be discussed and compared with the results of Experiment I. Retention of the German grammatical features by Experiment II group could be measured only after one day of exposure. Based on the data collected (Table B2b, p. 113), there is a 13% advantage by the experimental group (color) over the control group (black and white). In both experiment environments, Experiment I (in the regular German beginner class) and in Experiment II (in the controlled laboratory setting), the test results show that the color group outperformed significantly the black-and-white group. These findings suggest that color enhancement of the German grammatical features support superior learning of the material at the beginning as well as retaining knowledge better over time. It is helpful to find support in the field of neurocognition, so we can begin to understand that the reason for this outcome may lie in the various brain structures and the different mental pathways described in earlier paragraphs. Research in the neuropsychology field has found that the first area responding to vision, color, imagery and identification is located in the different vision systems of V1, V2 and V4 of the primary visual cortex in the occipital lobe, responsible for detailed object recognition, color processing, as well as in the ventral pathway, the “what” pathway (Carlson, 1998, Pinel, 2009, Kellogg, 2003). The presence of color might heighten attention at the onset of incoming new information and select it for special processing.

Time exposure across all five grammatical categories (articles in grammatical cases and articles in context with prepositions, Table A3d and A3e, p. 85:

First, for Experiment I: When comparing the control group and the experimental group in the nominative case on the first day of exposure and then after four weeks, both groups

(control and experimental) show a loss of knowledge of 5%. The difference lies in the performance level, i.e., the experimental group performs in both cases 11% higher than the control group. Further, it is noteworthy that the experimental group still performs better after four weeks than the control group on the first day of exposure.

Second, for Experiment II: When comparing the control group with the experimental group in this Experiment II environment, similar results could be recorded for the same grammatical categories. However, retention of grammatical material was tested after one day of first exposure. In the nominative case, the control group lost 5% knowledge from one day to the next, while for the experimental group no statistically significant loss could be recorded. For the other cases, the average loss of memory was 19% for the control group and 7.3% for the experimental group. It is noteworthy that the experimental group scored 7% higher one day after exposure than the control group did directly after exposure of the German grammatical material.

These data indicate an advantage of color enhancement in learning and memorizing German grammatical features. The results invite a comparison with average performance expectations of a regular German class. Taking into account that the grammatical features in the experiment are already enhanced, not only with color, but in general for all subjects by their presentation in black boxes (an enhancement which is said to promote attention and better learning), one might consider these results above average performance level of a standard German class. In this light, it can be safely suggested that color enhancement of German grammatical features could lead to considerably higher achievement levels for the student of the German language. Repeated verbal testimonials by the subjects to the experimenter support this claim. The students expressed preference for the color application of the German

grammatical material; they found it easier to separate the different grammatical categories in their mind as well as remember the specific grammatical forms better when associated with color.

Time exposure across article gender. For Experiment I: Also, performance of the article genders was recorded. Time exposure (first, second and third exposure) across all three article genders show no significant better performance for any article in particular. However, at the fourth exposure, i.e., after four weeks, both groups scored highest with the feminine article which indicates that in this study the feminine article is retained better than the masculine and the neuter articles. (In Experiment II, no difference in time effect across all three genders was recorded. This might be due to the short interval from one day of presentation of the grammatical material to the next day of testing it. The data show the special effect on the feminine article in Experiment I after an interval of 4 weeks).

First, the data do not reveal a logical reason for the outcome in Experiment I. However, these findings of better performance of the feminine article are consistent with anecdotal testimonials by the students to the experimenter, explaining that they just liked the feminine article best, for no particular reason. Whether this phenomena is reflected in the native German speaking population is not clear; this might be an area of further investigation, maybe in the field of conversation analysis (CA) where often particular usages of language are observed. However, one such research article by Patti Spinner and Alan Juffs (2008) addresses the use of the German article. They found, among a very small sample of foreigners living in Germany and trying to learn German in everyday life, i.e., not in an academic setting, a preference for the feminine article, to the degree that the feminine article was used where the correct article was masculine or neuter. This finding was also reported for the use of the

indefinite article as well as for the feminine form of adjectives. It is clear that this information alone does not offer enough data for explaining the finding of the statistically better outcome for the feminine article in this study. It offers, however, an opportunity for further discussions (and research) about possibilities of preference of the feminine article in the German language. Also, looking at developmental stages in article acquisition among native German children might be helpful in finding some general tendencies in a possible preference of the feminine article. As of now, no such research literature could be found.

Secondly, the higher performance for the feminine article is particularly surprising given that, when looking at the articles in the dative case, masculine *dem*, feminine *der*, neuter *dem*, one notices that the feminine dative case *der* looks the same as the masculine nominative case *der*. This could be confusing to the learner; however, the data show that, especially for the experimental group, there is no evidence for such argument. There is no scientific proof, but it raises the question whether color (green in this case) could possibly make a difference, signaling the exceptional article form in the dative case to be “*der*” for the feminine article.

Thirdly, another reason might be that “*die*” sounds very similar to the English “*the*”; so we could also be dealing with subconscious preference to a somewhat familiar English sound. This aspect would require further testing. (Transfer from first language, Van Patten, 2003).

Finally, the statistically better outcome for the feminine article might give rise to speculation for a future development of the German article. Should the three-gender article system ever develop into a simpler form, like its English cousin *the*, it might be conceivable that only the feminine article would survive; or perhaps more likely, a two-gender article system would remain, as in the Romance languages, the masculine and the feminine. One could also speculate on the basis of this study that the neuter article might disappear since the

neuter article was hardest to learn for the subjects. Overall, the neuter gender resulted in the lowest scores. With respect to a possibility of gender simplification, one can, however, look at Low German where the masculine and feminine articles merged into one article *de* (again, very similar to the English *the*), leaving a second gender, neuter *dat*. The Dutch language shows a similar pattern of only two article genders: *de* and *het*. Given the tendency in the closely related West Germanic languages of English, Dutch and Low German to merge the feminine and masculine (and even the neuter in the case of English) into a common gender on the basis of the masculine article, the preference of the study subjects for the feminine article remains puzzling.

Articles and nouns were tested across three grammatical cases (nominative, accusative and dative) and across articles and nouns in context with accusative and dative prepositions.

First, for Experiment I: Comparing the two groups, the results indicate a superior performance by the experimental group over the control group in all five grammatical categories. It is noteworthy that in this section, the experimental group outperformed the control group by an average of 16%, with the dative case scoring the highest.

With respect to a possible better performance in any particular article case, a general trend becomes evident throughout the experiment, especially in the experimental group (color), that the dative case appears to be the easiest to learn and to remember. An explanation for this trend may lie in the fact that in the dative case there are only two grammatical case forms to be learned: masculine *dem*, feminine *der* and neuter *dem*, instead of three cases in the nominative: masculine *der*, feminine *die*, neuter *das* and in the accusative: masculine *den*, feminine *die*, neuter *das*. This finding is thought provoking and hard to explain, if at all. One might find a parallel linguistic development of a tendency in the German article case system, a preference of the dative case, as the use of the genitive in conversation declines and is absorbed by the dative,

described in “Der Dativ ist dem Genitiv sein Tod” (Sick, 2007). On the other hand, it could be argued that the nominative case and the accusative case should be easier since they are nearly identical for all three articles (*der, die, das*), with the exception of the masculine article in the accusative case (*den*). It is, however, not probable that under the written rules for German grammar new tendencies in conversational German will find their way into the accepted grammar book and dictionary, the DUDEN, any time soon.

Isolation versus in context within full sentences: Also, testing the concept of learning grammar in isolation versus in context with complete sentences was part of this experiment in both environments, Experiment I (in the regular German class of the German Department) as well as Experiment II (in the controlled laboratory environment in the Psychology Department).

Many researchers and language teachers today hold the position that an important aspect of teaching foreign languages today is that L2 instructional material is better learned when presented in context within complete sentences, compared with lists of isolated words (Omaggio Hadley, 1993, VanPatten, 1996, Wong, 2005). When taking the data of test performance by both experimental groups together (control group and experimental groups of Experiment I), the findings are in concert with the present-day teaching philosophy of main stream language researchers and teachers who advocate teaching material be presented in comprehensible context, because of better learning and memory results. However, the data reveal, while articles and nouns are learned better at the first and second (repeat) time of exposure in the application of full sentences, this trend diminishes over time, and at the third exposure, after four weeks (no testing was done for this category after one week, as before), no superior performance is evident for either application (isolation vs. in context). The same

outcome was recorded for Experiment II, for both groups (control and experimental group), the application of grammatical features in isolation versus in context within sentences, showed a better score for grammatical material presented in context on day one, but already on the second day of testing, after one day, no statistical difference was registered between the two applications.

These findings lead to the question why, over time, there was no difference recorded between the two teaching application methods (isolation vs. in context). One could speculate that a reason might lie in the special presentation of German grammar material, i.e., enhanced through black boxes for both groups, the control as well as the experimental group, plus color for the experimental group. Another possibility might lie in the time exposure, that after a certain time students learn the grammatical features so well that it does not matter in which form they appear. However, since this trend becomes particularly obvious in the experimental group (color), the strongest argument might lie in the repeatedly recorded advantage of color application. Said color environment may have such a strong effect that it “washes out” the smaller boost in performance that is caused by the contextualized testing method.

Do these results possibly allow room for some rote learning for particular grammatical features? A follow-up discussion might lead to more ideas for future suggestions in this area. Nevertheless, these findings might be interesting and worthwhile to the L2 language instructors as an invitation to include specific rote learning exercises for particular grammatical features at given times.

Taking all the different data into account for both experimental environments Experiment I and Experiment II, the results of this experiment of using neurocognitive theory to develop a new approach for teaching German grammar reveal that color enhancement of

German grammatical features has a significant influence on learning and memory, a process which is aided by first noticing the color as a ‘flagged’ item, then attending to it for further processing through the mental pathways in the brain. This is supported by scientific brain research as it reveals that introducing color activates early visual areas (specifically V1 and V4) that might enhance the salience of the stimuli and increase attentional capture or selection, which is known to also improve encoding. Research literature also suggests that noticing and attention lead to better memory and retrieval of learned material. This process could be aided by the ventral brain system, which “responds to the characteristics of objects” (Pinel, 2009, pg. 155), it facilitates particular object-recognition, such as faces, bodies, letters, etc. (Pinel, 2009; Kellogg, 2003). This could mean that this brain system might be important for recognizing specially color-coded grammatical features, which, again, is an important aspect for this experiment. Included in the discussion is also the study of neuroimaging of visual mental imagery (Kosslyn & Thompson, 2003). Research has found that imagery has a positive influence upon long-term memory and retrieval, which is a fundamentally important goal of language learning and an important aspect of this study. Color coding grammatical features could be perceived by a language learner as a specific cue, marking a specific grammatical feature (like an image) which is especially noticed and paid attention to and then is stored in long-term memory for better retrieval (Kosslyn & Thompson, 2003). It is known that involving more brain regions/cognitive systems should facilitate encoding and aid in memory and retrieval.

The Group Embedded Figures Test (GEFT) did not have the predicted effect. A plausible reason is that the German grammatical material was presented in an already enhanced

application for both groups, this causing an overall “ceiling effect” of the overall enhanced performance.

In conclusion, the data of this experiment suggest that color enhancement can make a statistically significant difference in learning and remembering German grammatical material. The overall results of this research study give reason to propose that color enhancement of particular linguistic features can be considered a promising tool for better learning and retention of German grammar. These findings are not limited to German grammar learning alone; they could be adjusted and applied to foreign language learning in general, supported by the use of neurocognitive theory in developing a new approach for teaching foreign languages.

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APPENDIX A: Consent Form for Subjects from the German Department.

**Consent Form for Second Language Learning
Conducted by and Traute Kohler**

This study is designed to investigate how people learn and remember new languages. We will study this issue by presenting you with parts of German grammar and looking at how well you understand and remember words and word endings.

The German Grammar will be presented in different forms, there will be specific activities to highlight the pertinent grammar parts, followed by tests.

You will be asked to fill out a questionnaire of approximately 10 minutes. This questionnaire will give us a feel for how well you understood and remember the German words.

You are also asked to partake in the GEFT Test (Group Embedded Figures Test) for screening on the field-dependence and field-independence dimension of the individual learner. This is a one-time test. The simple task is to find common geometric shapes in a larger design, the results of which will give the researcher clues as to the individual's cognitive styles (FD or FI).

This test will be conducted throughout the semester. You can rest assured that the material presented is part of a regular German 104 class. There will be no more work than usual and no less than usual. There will be no disadvantage to you in participating in this study. You will not be exposed to any risks or discomforts during this experiment. You will be provided with more detailed instructions by the experimenter at the designed days as the course progresses.

Statement of Consent

I acknowledge that my participation in this experiment is entirely voluntary and I am free to participate or withdraw at any time. If I chose to decline, I will not be penalized in any way. I understand that the material presented is part of the subject matter of a regular German 104 Class. Further, I understand that all information obtained in this study is confidential. With my signature I acknowledge that I have received a copy of this consent form to keep.

Signature of Participant

Date

Please keep this form in case you have any further questions.

Any questions regarding this study can be answered by contacting:

Traute Kohler
German Department
2071 Wescoe Hall
Phone: 864-4803
e-mail: tkohler@ukans.edu

APPENDIX B: Consent Form for the Subjects in the Psychology Department:

CONSENT FORM (HSCL) # 15740
For Foreign Language Learning (German Grammar)
Conducted by Traute Kohler

This study is designed to investigate how students learn and remember foreign languages. I will explore this issue by using new strategies and material in teaching the German grammar. In particular, I will present the grammar in different forms, I will also use specific activities to highlight the pertinent parts, followed by tests. The activities and quizzes will give us a feel for how well you understand and remember the covered material.

This study will be conducted for three consecutive days, for approx. 55 minutes each day. It is important that you keep this time commitment in order to earn your credit.

You are also asked to partake in the GEFT Test (Group Embedded Figures Test) for screening on the field-dependence and field-independence dimension of the individual learner. This is a one-time test. The simple task is to find common geometric shapes in a larger design, the results of which will give the researcher clues as to the individual's cognitive styles (FD or FI).

There will be no disadvantage to you in participating in this study. You will not be exposed to any risks or discomforts during this experiment. You will be provided with more detailed instructions by the experimenter.

Statement of Consent

I acknowledge that my participation in this experiment is entirely voluntary and I am free to participate or withdraw at any time. If I chose to decline, I will not be penalized in any way. Further, I understand that all information obtained in this study is confidential. With my signature I acknowledge that I have received a copy of this consent form to keep.

Signature of Participant

Date

Please keep this form in case you have any further questions.

Any questions regarding this study can be answered by contacting:

Dr. Ruth Ann Atchley, Advisor Department of Psychology 457 Fraser Hall Phone: 864-9816 e-mail:ratchley@ukans.edu	or	Traute Kohler, Experimenter German Department 2071 Wescoe Hall Phone: 864-4803 e-mail: tkohler@ukans.edu
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Psychology Department

Date: _____

Research Approval # 15740

APPENDIX C: Questionnaire for Subjects in Experiment I and Experiment II:

German Faculty Advisor: Dr. William Keel

Psychology Faculty Adviser: Dr. Ruth Ann Atchley

Researcher: Traute Kohler

QUESTIONNAIRE (Confidential)

This questionnaire helps the investigator evaluate the results of the study of foreign language learning by taking into consideration the academic background of the participants. So, we ask you to please fill out this questionnaire. Your information will be treated with absolute confidentiality.

Student's Name: _____ Date: _____

E-mail: _____ Tel. No. _____

(Note: we need this information in case of a cancellation or any other unforeseen event, so we can contact you and inform you accordingly)

Do you have any previous knowledge of the German language: *yes* *no*

How many years? *one* *two* *three* *four* _____ *years* of German

Where? In *high school* *college* *family* or _____

Have you lived or visited in any German speaking country? *yes* *no*

Where? _____

For how long?: _____

How would you rate your German language skills? *good* *fair* *poor* *survival*

Do you know any other foreign languages? *yes* *no*

Which other languages do you know: *French* *Spanish* *Japanese* *other*

For how long did you study that language: _____
How would you rate your proficiency? _____

How do you like and/or feel about the German language:

APPENDIX D: From Page 73 – Description of:

**C. Day-by-Day Procedure of Experiment II (Experiment in the
Controlled Laboratory Environment of the Psychology Department)**

Day 1:

Step 1: On the first day, as described in the previous section, students were given a short explanation of the study without any details as to the particular goals of the experiment. They were asked to sign a consent form, issued by the University of Kansas. Subjects also were asked to fill out a questionnaire which would give information about their foreign language and German language background.

The subjects had no previous knowledge of the German language; their native language was American English.

Step 2: Introduction of the German grammar concept. The article “der, die, das” with their respective nouns were introduced in color (der, masculine, in blue; die, feminine, in red; das, neuter, in grey/black) and were explained in English, supported by flash cards, in isolated concept, in color for the experimental group and in black and white for the control group.

Step 3: Vocabulary of masculine, feminine and neuter articles and their respective nouns were presented on a study sheet with three rows (row 1) masculine, row 2) feminine and row 3) neuter), in color for the experimental group and in black and white for the control group.

Step 4: The same vocabulary, however, as a task sheet, still in rows of masculine, feminine and neuter categories. Subjects of the experimental group had to highlight the articles and nouns in color, subjects of the control group had to mark the articles in black and white, according to the correct genders.

Step 5: Test sheet in black and white for the above articles in front of their nouns had to be filled out by both groups in black and white, for the experimental and the control group, however, this time not in rows but in a scrambled version for testing.

Step 6: A study and task activity of articles in the nominative case and nouns embedded in complete sentences, with articles “der, die, das” and their respective nouns, in color for the experimental group and in black and white for the control group; after studying the material, the experimental group had to color in the boxes with the articles and nouns according to the correct gender, and the control group were given the task to mark the same material with just pencil grey/black.

Step 7: The same material in the same format was then tested. Grammar articles in the context of complete sentences. Both groups, the experimental group as well as the control group, had to fill in the correct article gender in the nominative case.

Step 8: Another study sheet with more vocabulary in rows of masculine, feminine and neuter, which were colored in blue, pink/red and grey/black for the experimental group and black and white for the control group.

Step 9: A study sheet with the same vocabulary, masculine, feminine and neuter articles in the nominative case, but now embedded in full sentences of a story “Ein Tag an der Ostsee in Deutschland”. Again, in color for the experimental group and black and white for the control group.

Step 10: A task sheet identical to the above study sheet, but this time the subjects had to highlight the article and their nouns in boxes in color for the experimental group and in pencil grey/black for the control group.

Step 11: A test sheet in black and white for both groups, the experimental group and the control group, in which they had to fill in the correct gender in the nominative case. The grammatical features were embedded in a text of a story “Ein Tag an der Ostsee in Deutschland”.

Step 12: Introduction of the all three genders in the accusative case, in orange for the experimental group and in black and white for the control group.

Step 13: The vocabulary list of masculine, feminine and neuter articles with their respective nouns (all in boxes) were revisited in the nominative case, in color for the experimental group and in black and white for the experimental group.

Step 14: The same vocabulary list was now presented as a study sheet with the articles and their nouns in the accusative case, in isolation, in color for the experimental group and in black and white for the control group.

Step 15: The same vocabulary list, in isolation, was now a task sheet in which the experimental group had to highlight all articles and their nouns in color whereas the control group had to highlight the same material in pencil grey/black.

Step 16: The same vocabulary with the articles in the accusative case was then tested in black and white for both groups, the experimental group and the control group. This time the words in isolation were scrambled, there was no reference as to their gender by the experimental group.

Step 17: This step was a study and task sheet. The grammatical features were presented in context of complete sentences, where the gender was indicated by color for the experimental group and unmarked for the control group. Then the experimental group had to highlight the

article and noun in the accusative case in color whereas the control group marked them in pencil grey/black.

Step 18: The same grammatical material in the same concept was now presented as a test sheet with only the nouns in the boxes (in color for the experimental group and in black and white for the control group), and where the articles in the accusative case had to be filled in.

Step 19: On the same day, also presented the accusative prepositions (durch, fuer, ohne, um, gegen) were presented, in color for the experimental group and in black and white for the control group.

Step 20: The grammatical features, accusative prepositions and accusative articles with their nouns, were presented in context of complete sentences, in color and with color clues as to the gender of the nouns for the experimental group and in black and white for the control group.

Step 21: The same material as above was now presented as a task sheet. The experimental group had to highlight the accusative preposition and the accusative article in color whereas the control group had to highlight the same features in pencil grey/black.

Step 22: This was a test sheet in black and white for both groups, the experimental groups and the control group. The articles had to be filled according to the correct case and gender; here they were preceded by accusative prepositions.

Day 2:

Step 1: Post-Test after one day, of the masculine, feminine and neuter articles in the nominative case, in isolated concept, in black and white for both groups, for the experimental group and the control group.

Step 2: Post-Test after one day, of the masculine, feminine and neuter articles in the nominative case, embedded in context of complete sentences.

Step 3: Post-test after one day, of the masculine, feminine and neuter articles in the nominative case, embedded in the context of a story “Ein Tag an der Ostsee in Deutschland”.

Step 4: Post-Test after one day, of the masculine, feminine and neuter articles and their nouns in the accusative case, in isolation.

Step 5: Post-Test after one day, of the masculine, feminine and neuter articles with their nouns in the accusative case, in context of complete sentences.

Step 6: Post-Test after one day, of the accusative case of the masculine, feminine and neuter articles and nouns when preceded by accusative prepositions, embedded in the context of complete sentences.

Step 7: Presentation of the dative case of the German article (dem, der, dem) in color green for the experimental group and in black and white for the control group.

Step 8: Refresher study sheet with the German article in the nominative case and nouns, presented in vocabulary rows in isolation, in rows of masculine, feminine and neuter categories, in color for the experimental group and in black and white for the control group.

Step 9: The same articles and nouns were presented in the same format as a study sheet, in isolation, only this time in the dative case, in color for the experimental group and in black and white for the control group.

Step 10: The same articles and nouns were presented as a task sheet in black and white for the subjects to highlight the dative articles and nouns, in color for the experimental group and in pencil grey/black for the control group.

Step 11: New articles in the dative case were now presented in another study sheet, in isolation, however, revisiting the nominative case and then leading to the dative case of the articles with nouns in isolation.

Step 12: A task sheet followed, the subjects had to fill in the dative case of the masculine, feminine and neuter articles, presented in rows according to gender; in color for the experimental group and in black and white for the control group.

Step 13: A study sheet followed with the dative case of the masculine, feminine and neuter articles and nouns, always in boxes, embedded in the context of a story “Birgit hat Geburtstag”.

Step 14: A task sheet identical to the above grammatical material embedded in the story “Birgit hat Geburtstag”, only here the subjects had to highlight the dative case of the articles and the nouns, in color for the experimental group and in pencil grey/black for the control group.

Step 15: The above exercises were followed by a test, again the identical grammatical set-up, however, with blanks for the dative articles in black and white, which had to be filled in by both groups, the experimental group and the control group.

Step 16: Introduction of the dative prepositions (aus, bei, mit, nach, seit, von, zu), in green for the experimental group and in black and white for the control group. Presented as study sheet, prepositions with articles and nouns in boxes, embedded in full sentences; in color for the experimental group and in black and white for the control group.

Step 17: The identical text in the same format was presented as a task sheet with color clues as to gender for the experimental group and only black and white for the control group. The task was to highlight the boxed-in grammatical features, i.e. the dative prepositions and the

articles with their nouns; in color for the experimental group and in pencil grey/black for the control group.

Step 18: The above preparative exercises were followed by a test with the same text and in the same format, embedded in full sentences; however, in black and white for both groups, in which the masculine, feminine and neuter articles in the dative case had to be filled in.

Step 19: Another study and task sheet was presented in the format of vocabulary rows identifying the masculine, feminine and neuter gender, in isolation. In color for the experimental group and in black and white for the control group. The task was to fill in the dative case of the articles.

Step 20: The above vocabulary in context with dative prepositions and articles were presented in boxes and embedded in context of a story “Ein Stadtbummel” as a study sheet.

Step 21: This was followed by a task sheet, the identical story in the same format as above. The task was to highlight the grammatical features in boxes, i.e. dative prepositions and masculine, feminine and neuter articles and their nouns, the experimental group had to highlight in color, whereas the control had to use pencil grey/black. The experimental group was given color clues as to the gender of the articles and nouns while the control group was presented with material in only black and white

Step 22: After the above preparatory activities followed the test for the correct dative case of the masculine, feminine and neuter articles which were preceded by dative prepositions. The test material was presented in black and white for both groups, the experimental group and the control group.

Day 3: Post-tests after one day; all test material was presented in black and white

only, for both groups.

Step 1: Post-test after one day of the dative case of the masculine, feminine and neuter article, embedded in a text of a story “Birgit hat Geburtstag”.

Step 2: Post-test after one day of the dative case of the masculine, feminine and neuter articles when preceded by dative preposition; the grammatical features were in boxes and embedded in complete sentences.

Step 3: Post-test after one day of the dative case of the masculine, feminine and neuter articles when preceded by dative prepositions; the grammatical features were in boxes and embedded in the context of a story “Ein Stadtbummel”.

Step 4: The GEFT Test was administered, under strict guidelines of the instructions (see Appendix O).

Step 5: At the end of the experiment the students were asked to fill out an evaluation sheet what most of them were eager to do (see Appendix N)

APPENDIX E: **Day 1 Step I:** Introduction of the **German article**
der, die, das = in English
supported by colored flash cards, in color
for the Experimental Group

der Wind

die Sonne

das Wetter

Appendix F:

Step I: Introduction of the **German article der, die, das** = in English the
supported by non-colored flash cards, in black and white
for the Control Group

der Wind

die Sonne

das Wetter

Appendix G: - Cont.

Day 1 Step II: Introduction of the German article **der, die, das** = in Engl. the
In isolated concepts, i.e. articles with corresponding nouns, in color

Color Sheet for Experimental Group

der (masculine)
 marked in blue

die (feminine)
 marked in red

das (neuter)
 marked grey/
 neutral

der Student

the(m.) student

die Studentin

the (fem.) student

das Wetter

the weather

der Himmel

the sky

die Sonne

the sun

das Wasser

the water

der Wind

the wind

die Taube

the pigeon

das Paar

the pair

der Sand

the sand

die Möwe

the seagull

das Brot

the bread

der Strandkorb

the beach basket

die Freude

the joy

das Meer

the sea

der Freund

the boyfriend

die Freundin

the girlfriend

das Segelboot

the sailboat

der Sturm

the storm

die Welle

the wave

das Segel

the sail

der junge Mann

the young man

die junge Frau

the young woman

das Boot

the boat

der Schreck

the shock

die Angst

the fear

das Glück

the good fortune

Appendix H: - Cont.

Day 1, Step II: Introduction of the **German article der, die, das** = in Engl. the

In isolated concepts, i.e. articles with corresponding nouns

Non-Color Sheet for Control Group

der (masculine) **die** (feminine) **das** (neuter)

der Student

the(m.) student

die Studentin

the (fem.) student

das Wetter

the weather

der Himmel

the sky

die Sonne

the sun

das Wasser

the water

der Wind

the wind

die Taube

the pigeon

das Paar

the pair

der Sand

the sand

die Möwe

. the seagull

das Brot

the bread

der Strandkorb

the beach basket

die Freude

the joy

das Meer

the sea

der Freund

the boyfriend

die Freundin

the girlfriend

das Segelboot

the sailboat

der Sturm

the storm

die Welle

the wave

das Segel

the sail

der junge Mann

the young man

die junge Frau

the young woman

das Boot

the boat

der Schreck

the shock

die Angst

the fear

das Glück

the good fortune

Appendix I:

Day 1, Step III: STUDY-SHEET (for Experimental Group)

The German article **der, die, das** embedded in a text = in English the

der (masculine) - **marked in blue**

die (feminine) - **marked in red**

das (neuter) - **marked in grey/neutral**

Ein Tag an der Ostsee in Deutschland

A day at the Baltic Sea in Germany

Der Student aus Amerika und **die Studentin** aus Deutschland verbringen einen Tag am
The student from America and the student from Germany are spending a day at the

Strand an der Ostsee. Das Wetter ist fantastisch: **die Sonne** scheint, **der Himmel** ist
beach at the Baltic Sea. The weather is fantastic: the sun is shining, the sky is

blau, der Wind ist sanft, **der Sand** ist weiss und warm, **das Wasser** ist kühl. **Das Paar**
blue, the wind is soft, the sand is white and warm, the water is cool. The pair

liegt im Strandkorb. Der Strandkorb schützt vor Wind und ist sehr gemütlich
lies in the beach basket, The beach basket protects against wind and is very cozy

für ein Picknick. Oh je! das Brot fällt runter. **Die Möwe** und **die Taube** merken das
for a picnic. Oh, dear! The bread falls down. The seagull and the pigeon notice that

gleich, picken es auf und fliegen weg. -
immediately, pick it up and fly away.

Der Freund will jetzt segeln. **Die Freundin** kommt mit. **Das Segelboot** ist klein, gerade
The boyfriend wants to go sailing now. The girlfriend comes along. The sailboat is small, just

gut für zwei Personen. Sie segeln hinaus aufs Meer. Das Meer ist jetzt unruhig.
right for two people. They sail out into the sea. The ocean is restless now.

Der Sturm tobt, **das Segel** zerreist, **das Boot** kentert, **die Welle** verschluckt es.
The storm rages, the sail rips apart, the boat capsizes, the wave swallows it.

Der junge Mann und **die junge Frau** sind jetzt im Wasser und schwimmen
The young man and the young woman are now in the water and swim

zurück zum Land. Der Schreck war gross, aber jetzt ist **die Angst** vorbei
back to the land. The shock was big, but now the fear is over

und **das Glück** siegt. **Die Freude** ist gross, sie sind glücklich!
and the good fortune prevails. The joy is great, they are happy!

Appendix J:

Day 1, Step III: STUDY-SHEET (for Control Group)

The German article **der, die, das** embedded in a text = in English the
der (masculine)
die (feminine)
das (neuter)

Ein Tag an der Ostsee in Deutschland

A day at the Baltic Sea in Germany

Der Student aus Amerika und **die Studentin** aus Deutschland verbringen einen Tag am
The student from America and the student from Germany are spending a day at the

Strand an der Ostsee. Das Wetter ist fantastisch: **die Sonne** scheint, **der Himmel** ist
beach at the Baltic Sea. The weather is fantastic: the sun is shining, the sky is

blau, der Wind ist sanft, **der Sand** ist weiss und warm, **das Wasser** ist kühl. **Das Paar**
blue, the wind is soft, the sand is white and warm, the water is cool. The pair

liegt im Strandkorb. Der Strandkorb schützt vor Wind und ist sehr gemütlich
lies in the beach basket, The beach basket protects against wind and is very cozy

für ein Picknick. Oh je! das Brot fällt runter. **Die Möwe** und **die Taube** merken das
for a picnic. Oh, dear! The bread falls down. The seagull and the pigeon notice that

gleich, picken es auf und fliegen weg. -
immediately, pick it up and fly away.

Der Freund will jetzt segeln. **Die Freundin** kommt mit. **Das Segelboot** ist klein, gerade
The boyfriend wants to go sailing now. The girlfriend comes along. The sailboat is small, just

gut für zwei Personen. Sie segeln hinaus aufs Meer. Das Meer ist jetzt unruhig.
right for two people. They sail out into the sea. The ocean is restless now.

Der Sturm tobt, **das Segel** zerreist, **das Boot** kentert, **die Welle** verschluckt es.
The storm rages, the sail rips apart, the boat capsizes, the wave swallows it.

Der junge Mann und **die junge Frau** sind jetzt im Wasser und schwimmen
The young man and the young woman are now in the water and swim

zurück zum Land. Der Schreck war gross, aber jetzt ist **die Angst** vorbei
back to the land. The shock was big, but now the fear is over

und **das Glück** siegt. **Die Freude** ist gross, sie sind glücklich!
and the good fortune prevails. The joy is great, they are happy!

Appendix K - Cont.

Day 1, Step IV: TASK-SHEET (for the Experimental Group)Please, highlight the articles as follows:der (masculine) - **in blue**die (feminine) - **in red**das (neuter) - **neutral**

Ein Tag an der Ostsee in Deutschland

*A day at the Baltic Sea in Germany***Der Student** aus Amerika und **die Studentin** aus Deutschland verbringen einen Tag am*The student from America and the student from Germany are spending a day at the***Strand an der Ostsee. Das Wetter** ist fantastisch: **die Sonne** scheint, **der Himmel** ist*beach at the Baltic Sea. The weather is fantastic: the sun is shining, the sky is***blau, der Wind** ist sanft, **der Sand** ist weiss und warm, **das Wasser** ist kühl.*blue, the wind is soft, the sand is white and warm, the water is cool.***Das Paar** liegt im Strandkorb. **Der Strandkorb** schützt vor Wind und ist sehr*The pair lies in the beach basket, The beach basket protects against wind and is very***gemütlich für ein Picknick. Oh je! das Brot** fällt runter. **Die Möwe** und **die Taube***cozy for a picnic. Oh, dear! The bread falls down. The seagull and the pigeon***merken das gleich, picken es auf und fliegen weg. -***notice that immediately, pick it up and fly away.***Der Freund** will jetzt segeln. **Die Freundin** kommt mit. **Das Segelboot** ist klein, gerade*The boyfriend wants to go sailing now. The girlfriend comes along. The sailboat is small, just***gut für zwei Personen. Sie segeln hinaus aufs Meer. Das Meer** ist jetzt unruhig.*right for two people. They sail out into the sea. The ocean is restless now.***Der Sturm** tobt, **das Segel** zerreist, **das Boot** kentert, **die Welle** verschluckt es.*The storm rages, the sail rips apart, the boat capsizes, the wave swallows it.***Der junge Mann** und **die junge Frau** sind jetzt im Wasser und schwimmen*The young man and the young woman are now in the water and swim***zurück zum Land. Der Schreck** war gross, aber jetzt ist **die Angst** vorbei*back to the land. The shock was big, but now the fear is over***und das Glück** siegt. **Die Freude** ist gross, sie sind glücklich!*and the good fortune prevails. The joy is great, they are happy!*

Appendix L - Cont.

Day 1, Step IV: **TASK-SHEET** (for the Control Group)**Please, highlight the articles as follows:****der** (masculine) - in pencil grey**die** (feminine) - in pencil grey**das** (neuter) - in pencil grey

Ein Tag an der Ostsee in Deutschland

*A day at the Baltic Sea in Germany***Der Student** aus Amerika und **die Studentin** aus Deutschland verbringen einen Tag am*The student from America and the student from Germany are spending a day at the***Strand an der Ostsee. Das Wetter** ist fantastisch: **die Sonne** scheint, **der Himmel** ist*beach at the Baltic Sea. The weather is fantastic: the sun is shining, the sky is***blau, der Wind** ist sanft, **der Sand** ist weiss und warm, **das Wasser** ist kühl.*blue, the wind is soft, the sand is white and warm, the water is cool.***Das Paar** liegt im **Strandkorb**. **Der Strandkorb** schützt vor Wind und ist sehr*The pair lies in the beach basket, The beach basket protects against wind and is very***gemütlich für ein Picknick. Oh je! das Brot** fällt runter. **Die Möwe** und **die Taube***cozy for a picnic. Oh, dear! The bread falls down. The seagull and the pigeon***merken das gleich, picken es auf und fliegen weg. -***notice that immediately, pick it up and fly away.***Der Freund** will jetzt segeln. **Die Freundin** kommt mit. **Das Segelboot** ist klein, gerade*The boyfriend wants to go sailing now. The girlfriend comes along. The sailboat is small, just***gut für zwei Personen. Sie segeln hinaus aufs Meer. Das Meer** ist jetzt unruhig.*right for two people. They sail out into the sea. The ocean is restless now.***Der Sturm** tobt, **das Segel** zerreist, **das Boot** kentert, **die Welle** verschluckt es.*The storm rages, the sail rips apart, the boat capsizes, the wave swallows it.***Der junge Mann** und **die junge Frau** sind jetzt im Wasser und schwimmen*The young man and the young woman are now in the water and swim***zurück zum Land. Der Schreck** war gross, aber jetzt ist **die Angst** vorbei*back to the land. The shock was big, but now the fear is over***und das Glück** siegt. **Die Freude** ist gross, sie sind glücklich!*and the good fortune prevails. The joy is great, they are happy!*

Appendix M - Cont.

Day 1, Step V: TEST-SHEET (for Experimental and Control Group)

Please, write in the correct articles as best as you can remember

der (masculine)

die (feminine)

das (neuter)

Ein Tag an der Ostsee in Deutschland

A day at the Baltic Sea in Germany

Student aus Amerika und Studentin aus Deutschland verbringen einen Tag am
The student from America and the student from Germany are spending a day at the

Strand an der Ostsee. Wetter ist fantastisch: Sonne scheint, Himmel ist
beach at the Baltic Sea. The weather is fantastic: the sun is shining, the sky is

blau, Wind weht sanft, Sand ist weiss und warm, Wasser ist kühl.
blue, the wind blows softly the sand is white and warm, the water is cool.

Paar liegt im Strandkorb. Strandkorb schützt vor Wind und ist sehr
The pair lies in the beach basket, The beach basket protects against wind and is very

gemütlich für ein Picknick. Oh je! Brot fällt runter. Möwe und Taube
cozy for a picnic. Oh, dear! The bread falls down. The seagull and the pigeon

merken das gleich, picken es auf und fliegen weg. -
notice that immediately, pick it up and fly away.

Freund will jetzt segeln. Freundin kommt mit. Segelboot ist klein,
The boy friend wants to go sailing now. The girl friend comes along. The sailboat is small,

gut für zwei Personen. Sie segeln hinaus aufs Meer. Meer ist jetzt unruhig.
right for two people. They sail out into the sea. The ocean is restless now.

Sturm tobt, Segel zerreist, Boot kentert, Welle verschluckt es.
The storm rages, the sail rips apart, the boat capsizes, the wave swallows it.

junge Mann und junge Frau sind jetzt im Wasser und schwimmen
The young man and the young woman are now in the water and swim

zurück zum Land. Schreck war gross, aber jetzt ist Angst vorbei
back to the land. The shock was big, but now the fear is over

und Glück siegt. Freude ist gross, sie sind glücklich!
and the good fortune prevails. The joy is great, they are happy!

Step VI: This test was repeated as a post-test after one week and four weeks.

Appendix N:

German Dept., Advisor; prof. William Keel
 Psychology Dept., Advisor: Prof. Ruth Ann Atchley
 Researcher: Traute Kohler
 Observer: _____

Name: _____
 Date: _____
 Class Time: _____
 Group A (Experimental)

EVALUATION

Your evaluation of the past study on the German article is important for the investigator.

It will help evaluate the experiment and the effect of the testing procedure. Your statements will be treated confidentially; you may or may not state your name.

1. How did you like the color-coded grammar (German articles/cases):

2. Did the color-coded grammar help you in memorizing the gender (masc., fem., neuter) and cases of the article (der, die, das):

3. How effective was the change in color from nominative (blue, red and grey) to accusative (orange) and dative (green)

4. How did you like the activity/task of color-coding the grammar; did this particular task
 A) help you remember the grammar

B) distract you from learning the grammar

C) did not make any difference

5. Which format was easier to remember

A) articles with nouns in isolated concepts:

a) why so

B) articles with nouns embedded in a text

b) why so

6. How would you judge the amount of material presented and tested:

from A) easy to manage to E) overwhelming: A) ____ B) ____ C) ____ D) ____ E) ____

7. Did you have enough time to complete the studies and tasks: _____

8. Did you find the explanations given understandable/adequate _____
 or did you not always understand what was asked of you _____

The next three questions refer to the presentation of the articles embedded in a text (articles in sentences/stories versus pres. in isolated concepts). Please, answer:

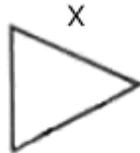
9. a) Did you follow the German text with the English translations: Yes _____ No _____
 b) Rate your understanding of the German text from : **1** (not at all) **to 5** (understood very well **1**_____ **2**_____ **3**_____ **4**_____ **5**_____
10. a) Did you read/rely on the Engl.translations only and ignored the German text: Yes _ No_
 b) How much did you rely on the English translations. Please rate from A to E:
A (100%)_____, **B** (75%)_____, **C** (50)%_____, **D** (25%)_____, **E** (0%) _____.
11. Did you ignore the text altogether, and focused only on the articles and nouns: Yes ___ No _
12. Was there an article gender which was easier to remember than another: der __ die __ das __

Extra Comments:

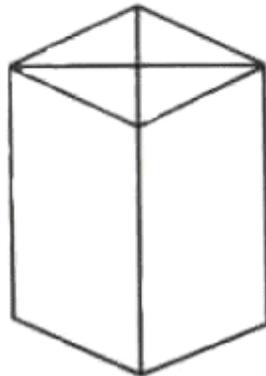
Appendix O:

Sample image from the Group Embedded Figures Test (GEFT)

Here is a simple form which we have labeled "X":



This simple form, named "X", is hidden within the more complex figure below:



The GEFT is a test for use in organizational assessment.