Note-taking and Information Retention and Recall

A thesis submitted to the College of Communication and Information of Kent State University in partial fulfillment of the requirements for the degree of Master of Fine Arts

by

Gary E. Meacher

May, 2012
Thesis written by
Gary E. Meacher
B. A., Cleveland State University, 2008
M.F.A., Kent State University, 2012

Approved by

_______________________________________
Ken Visocky O’Grady, Advisor

_______________________________________
AnnMarie LeBlanc, Director, School of Visual Communication Design

_______________________________________
Dr. Stanley T. Wearden, Dean, College of Communication and Information
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>TABLE OF CONTENTS</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIST OF FIGURES</td>
<td>v</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>vii</td>
</tr>
<tr>
<td>ACKNOWLEDGMENTS</td>
<td>viii</td>
</tr>
</tbody>
</table>

## CHAPTER

I. INTRODUCTION  .................................................................................................................. 1

   DEVELOPMENT OF STUDY SKILLS ................................................................................ 1

II. LEARNING .......................................................................................................................... 6

   BRAIN AND MEMORY ......................................................................................................... 8

III. THE MIDDLE GRADES....................................................................................................... 10

   NOTE-TAKING ...................................................................................................................... 12

   ATTENTION ........................................................................................................................ 15

   LEARNING STYLES ............................................................................................................. 16

IV. THE RESEARCHABLE QUESTION ....................................................................................... 18

   ASSUMPTIONS ..................................................................................................................... 18

V. PRIMARY RESEARCH......................................................................................................... 19

   ETHNOGRAPHIC RESEARCH ............................................................................................... 19

   SURVEY .............................................................................................................................. 21

   RESULTS ............................................................................................................................ 24

   PERSONAS .......................................................................................................................... 28

   TECHNOLOGY ..................................................................................................................... 31
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Gender breakdown of survey participants.</td>
<td>22</td>
</tr>
<tr>
<td>2. Achievement levels of survey participants.</td>
<td>25</td>
</tr>
<tr>
<td>3. Whether they take notes or not</td>
<td>26</td>
</tr>
<tr>
<td>4. Whether they were taught how to take notes.</td>
<td>27</td>
</tr>
<tr>
<td>5. What grade they were taught how to take notes.</td>
<td>28</td>
</tr>
<tr>
<td>6. User personas.</td>
<td>30</td>
</tr>
<tr>
<td>7. Taking notes in notebooks or with electronics.</td>
<td>32</td>
</tr>
<tr>
<td>8. Study habits</td>
<td>35</td>
</tr>
<tr>
<td>9. Notable branding / identity.</td>
<td>37</td>
</tr>
<tr>
<td>10. Login wireframe.</td>
<td>38</td>
</tr>
<tr>
<td>11. Notes library wireframe.</td>
<td>39</td>
</tr>
<tr>
<td>12. Sidebar and keyboard layout wireframe.</td>
<td>40</td>
</tr>
<tr>
<td>13. Fullscreen typing wireframe.</td>
<td>40</td>
</tr>
<tr>
<td>14. Freeform and mind mapping interface wireframe.</td>
<td>41</td>
</tr>
<tr>
<td>15. Mind mapping tools, shapes and size preferences interface wireframe.</td>
<td>42</td>
</tr>
<tr>
<td>16. Social profile version one wireframe.</td>
<td>43</td>
</tr>
<tr>
<td>17. Social profile version two wireframe.</td>
<td>44</td>
</tr>
<tr>
<td>18. Features introduction page.</td>
<td>45</td>
</tr>
<tr>
<td>19. Features introduction page, revised.</td>
<td>46</td>
</tr>
<tr>
<td>20. Settings options. Freeform and mind mapping nomenclature.</td>
<td>47</td>
</tr>
<tr>
<td>21. Writing and drawing area, lack of navigation back to the typing method of note.</td>
<td>48</td>
</tr>
<tr>
<td>22. Writing and drawing area revised with a typing area navigational element.</td>
<td>49</td>
</tr>
<tr>
<td>23. Log in screen.</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>24.</td>
<td>Log in screen with keyboard active.................................51</td>
</tr>
<tr>
<td>25.</td>
<td>Get started.........................................................................52</td>
</tr>
<tr>
<td>26.</td>
<td>Notes homepage.................................................................53</td>
</tr>
<tr>
<td>27.</td>
<td>App settings.........................................................................54</td>
</tr>
<tr>
<td>28.</td>
<td>View completed notes..........................................................55</td>
</tr>
<tr>
<td>29.</td>
<td>Note-taking process (typing)................................................56</td>
</tr>
<tr>
<td>30.</td>
<td>Note-taking process (typing) full screen...............................57</td>
</tr>
<tr>
<td>31.</td>
<td>Word pop-up...........................................................................58</td>
</tr>
<tr>
<td>32.</td>
<td>Font color options...............................................................59</td>
</tr>
<tr>
<td>33.</td>
<td>Writing and drawing mode....................................................60</td>
</tr>
<tr>
<td>34.</td>
<td>Illustration color options...................................................61</td>
</tr>
<tr>
<td>35.</td>
<td>Brush thickness option.........................................................62</td>
</tr>
<tr>
<td>36.</td>
<td>Shapes tool and mind mapping example................................63</td>
</tr>
<tr>
<td>37.</td>
<td>Assembly profile....................................................................64</td>
</tr>
<tr>
<td>38.</td>
<td>Assembly badges....................................................................65</td>
</tr>
<tr>
<td>39.</td>
<td>Assembly news feed..............................................................66</td>
</tr>
<tr>
<td>40.</td>
<td>Assembly private messages..................................................67</td>
</tr>
<tr>
<td>41.</td>
<td>Assembly friends....................................................................68</td>
</tr>
<tr>
<td>42.</td>
<td>Assembly chat sessions.......................................................69</td>
</tr>
<tr>
<td>43.</td>
<td>Quiz menu...............................................................................70</td>
</tr>
<tr>
<td>44.</td>
<td>Quiz taking process..............................................................71</td>
</tr>
<tr>
<td>45.</td>
<td>Quiz correct answer pop-up.................................................72</td>
</tr>
<tr>
<td>46.</td>
<td>Quiz incorrect answer pop-up..............................................73</td>
</tr>
</tbody>
</table>
### LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. General background of survey participants.</td>
<td>24</td>
</tr>
<tr>
<td>2. Achievement levels of survey participants.</td>
<td>24</td>
</tr>
<tr>
<td>3. Learning preferences of survey participants.</td>
<td>25</td>
</tr>
</tbody>
</table>
ACKNOWLEDGMENTS

I’d like to thank the faculty and staff of Kent State University, including my thesis committee, for their guidance through this process and contagious passion for the field of design and technology. I’d like to acknowledge my family for their support during the development of this thesis. Equally as important, I’d like to thank Amy Peck for being a sounding board at all stages of the graduate school experience, her drive and dedication only fueled my own and helped me take my work to a higher level. Last but not least, thanks goes to my beautiful girlfriend Mia Roberge and her endless understanding, sacrifice, and emotional support that helped me stay focused and get through every day.
Chapter I

INTRODUCTION

Information retention is paramount to the education process. There is not a single act in academia that does not require extensive information recall. “Every exam tests memorization. Classroom participation is an exercise in revealing your memory—physics, math, history, economics, geography—every single subject requires dozens of hours of memorization” (Adler Jr., 1988, xii - xiv). This copious demand on memory gradually increases with age as students develop.

DEVELOPMENT OF STUDY SKILLS

Skills for remembering typically develop in the context of experiences in settings, such as school. School is a prime example of experience driven developments because the use of memory is expected and valued (Waters & Schneider, 2010). Increased demands on memory place a much larger emphasis on study skills, more importantly good study skills. Describing good memory and study skills is complicated, because there are several factors that influence a student’s success in memorizing and later learning information. “Not only do children have to determine when they need to study, what needs to be studied, and how long to study, but they also have to choose a method or methods for studying” (Rafoth, Leal, & DeFabo, 1993, p. 23). These studying and memory strategies make up the activities that students perform when trying to remember or learn information. These methods evolve as students develop with age. With increase in age across the elementary years, children become more proficient in their use of strategies. There are further developments in how they plan to store the information and how they might retrieve the information at a later date (Waters & Schneider, 2010). Intentional use of memory
strategies have been documented in children around two years of age. Initially their usage is simple, direct and require very low amounts of processing time. The purposeful use of memory strategies only occurs when someone prompts the child to remember something. As time goes on, closer to six years of age, children begin to rehearse things they want to remember. Elementary school marks a period in which children transition from passive to active learning techniques for remembering. Often students are instructed at this age to write things over and over again to help them remember. For example, new spelling words might be written five times each, a phone number repeated out loud in preparation of dialing or basic math problems. Rehearsal as a strategy undergoes a qualitative change with age. A study conducted by developmental psychologist and distinguished at the University of North Carolina at Chapel Hill Professor Peter Ornstein and his colleagues focused on third, sixth, and eighth grade students as they studied a list of words. Third graders (nine years old) rehearsed the words one item at a time (i.e., “desk, desk, desk, desk” and “cat, cat, cat, cat”). Both older groups of students from the sixth and eighth grade rehearsed sets of items (i.e., “desk - cat - shirt - sky, desk - cat - shirt - sky”). Ornstein also discovered that the older students recalled more of the words when they were tested later and believes that this better performance can be attributed to their use of a more sophisticated rehearsal strategy. Although using the rehearsal method to study has proven to help students learn eventually, the strategy itself is not a meaningful way to process information and is often not the most effective for remembering. Younger children expend more attentional energy while rehearsing than older children. Older children tend to rely more on relating and past experiences while rehearsing (Waters & Schneider, 2010). As children gain more experience in learning and study skills,
they acquire more sophisticated means and are less likely to use the rehearsal method (Rafoth, Leal, & DeFabo, 1993).

Increasing age begets an increase in multiple study strategies to remember. The more strategies students become aware of the less likely they are to use ineffective methods. Siegler’s Strategy Choice Model states that after experimenting with different study strategies, understanding any progression or regressive directions taken as a result, most children will focus on the best, logical strategy and lock onto it for much of the remainder of their lives (Goldman, 2008). Given their state of development, most children house a variety of methods in which to solve problems and may use different strategies for similar problems.

For example, there are at least three common strategies that children can use for addition. The first is fact retrieval: \(3 + 3\) always equals 6. The second is the min strategy, where kids count up from the larger number: \(9 + 2 = (9 + 1) + 1 = 10 + 1 = 11\). The third is decomposition into easily manipulated numbers: \(19 + 22 = 19 + 20 + 2 = 39 + 2 = 41\). Normally developing children will ultimately lock into one of these or another strategy when faced with a random addition problem.

Likewise, there are different strategies for reading words – letter by letter, phoneme by phoneme, whole-word memory-based retrieval, and so forth. (Goldman, 2008)

Children begin to understand the link between the use of the strategies and the successful outcomes, and this begins to build their metacognitive knowledge of themselves as learners.

Up to this point in student progression, any shortcomings in memory are not for a lack of knowledge, but a failure to fully understand how to apply the knowledge. By the fifth grade that the major developmental leaps in strategy use occur.
Organizational, elaborative, and self testing methods of studying become a part of the student skill set by the fifth grade and further develop into the adolescence stages of a child’s life.

Organizational strategies involve reorganizing information into semantic, meaningful groups. Clumping vocabulary words into lists by the first few letters, sorting different types of movies by their genre, and grouping tools together by how they are used are all examples of semantic organization.

Elaborative strategies involve creating connections that add meaning to the things that are trying to be committed to memory. These connections usually involve images or phrases. The phrase “Roy G. Biv” is a verbal elaboration to aid in remembering red, orange, yellow, green, blue, indigo, and violet as the order and colors of a rainbow. A visual elaboration might be when a student is reading a book and pictures the character in his/her mind while imagining the events of the story.

Lastly, self-testing strategies are activities that are aimed at determining whether the student is comfortable enough with the materials to stop studying. Self-testing is a great way to decide if one has studied enough. Practice tests, flash cards, and looking away while reciting are all examples of self-testing. In actuality, while third grade students have been documented as using self-testing techniques, the development that takes place at the fifth grade level is what truly takes the process to a more meaningful level. Fifth graders are more likely to use the information that self-testing provides to their advantage. If something is not quite sinking in, a fifth grader would be more likely to continue studying the material that he/she missed while self-testing until subsequent self-testing proves they have mastered the material. That maturation in the educational process is key for the 11–13 year old age group (Rafoth, Leal, & DeFab, 1993). It is critical that self-testing as a way of monitoring learning is
in place by the seventh or eighth grade. As evidenced in the study habits of successful students, practice tests are an essential strategy. Practice tests can help alter the length of study time needed, divert the direction of studying to more challenging areas and truly develop an understanding of how well the student is comprehending the material. Self-testing is proof of the development of metamemory.

Metamemory is often referred to as knowledge of one’s own memory—how it works, what factors influence it, and what strategies are useful in helping to remember things (Larkin, 2010). Metamemory consists of three major factors: person, task, and strategy.

**Person factors** are relating to everything one knows about one’s own memory and the memory of other people.

- Knowing that one sometimes forget things
- Knowing whether or not one knows something
- Knowing that older children know more than younger children
- Understanding that people are thinking beings and that they all think differently

**Task factors** refer to everything one knows about performing tasks for the sake of memory.

- Knowing that remembering something exactly is much more difficult than recalling it generally
- Knowing that relearning something is easier than learning it for the first time
- Knowing that performing tasks to help remember things later is easier than performing tasks that help recall
- Knowing that one should devote more study time to difficult material
• Knowing about tasks in general— are they related to previously performed tasks? Do we have all the information needed to perform the task? Can the success or failure of performing the task be predicted (Larkin, 2010)?

Strategy factors are everything one knows about the techniques of learning and remembering.

• Knowing about using mnemonic methods like rehearsing, organizing, elaborating, and self-testing

• Knowing that using strategies can help performance

(Rafoth, Leal, & DeFabo, 1993, p. 33)

Chapter II

LEARNING

There is no memory without learning, and there is no learning without memory; the two are not mutually exclusive. Memory is an indicator of learning. Information gets processed into memory, which in turn fosters learning. Whether or not something is learned can be identified by three major cues: demonstration of an ability to recall information, performance on a measurable task such as a quiz, and a change in behavior (Dehn, 2010). All learning begins in the self-system of the brain. The self-system makes the decision as to whether the student is willing to pay attention or start a task. How is that decision made? It’s based on personal importance, self-efficacy, and the overall emotion towards learning.

Personal importance is driven by the need to satisfy a goal. If there is a task at hand but no clear goal, the motivation for performing the task is very low. It is important that teachers instruct their students based on goals. Before introducing something new, defining the reason behind why it is important to learn is paramount to the educational process. Often one might hear a student say “How does this apply
to real life?”, or “I’m never going to do algebra outside of school, a computer will do it for me.” Setting goals and prefacing new information can help avoid these frustrating situations.

Self-efficacy is based on fact, “I know I can...” This is not to be confused with self-esteem, which is “I believe I can...”. Previous success in anything breeds self-efficacy in later success (Tileston, 2005). “I know I can do this; I’ve done it before”.

Having self-efficacy is not only important for future successes, but is also part of an internal dialogue that a student has with himself that remind him that he has the capacity to be successful. Knowing that at one time he did something right leaves him with the confidence that they can continue along those lines. This sensitive balance of emotion leads to the last important factor in deciding whether or not a student wants to pay attention and learn— the overall emotion towards learning.

The learning process can be stressful and challenging. While under stress, students are unable to learn or make clear decisions. “Stress makes us stupid” (Tileston, 2005, p. 5). The fundamental behavior of the brain revolves around survival. The most important aspect of survival is identifying and handling threats. The brain prioritizes the threat of being stressed and monopolizes its power to do anything else effectively. A negative mood before starting a study session leads to a more difficult time learning. There are two sides to this coin. A negative mood towards the learning process can lead to a lack of a willingness to pay attention or challenge one’s self. Conversely, the difficulty in the learning process as a result of the negative mood can cause the student to invest more time and effort into the study session and therefore foster a higher level of thinking. A positive mood before a study session can help the student maintain their focus throughout and increase their resilience to a heavy workload (Larkin, 2010).
BRAIN AND MEMORY

The brain makes use of three processes to form a memory: encoding, storage, and retrieval. Encoding involves interpreting and organizing information, which is then stored away until reactivated or retrieved. 98% of information enters the brain through the five senses. Once information enters the brain, it meets a crossroad where it is either tossed out or sent to the memory areas. Generally, there are two kinds of memory, short-term and long-term memory (Bligh, 2000).

Short-term memory refers to the working memory or the place where conscious thinking and information processing takes place. For example, the information for dialing an unfamiliar phone number would be stored in short-term memory. There is approximately 20–30 seconds until that information is forgotten or learned and transmitted to the long-term memory. Over time, short-term memory becomes less and less critical as its capacity increases with new study strategies and developing skills. In preschool, children are able to hold two items at once in their short-term memory. In preadolescent stages, children can hold closer to five items. Finally, in the adolescent and adult stages of development, an average of seven items can be stored in short-term memory (Tileston, 2005). When a child is learning to read, he focuses on understanding or decoding the words as he reads them. Once he is fluent and comfortable with reading, he focuses on other things, and decoding words takes up far less space in the short-term memory.

Long-term memory is formed through practice, repeated rehearsal, and meaningfulness, that is to say, things that are very important or personally meaningful are easily transmitted to long-term memory, the storehouse of information. Children before the fifth grade are not very successful at distinguishing
levels of meaning, most vs. least especially (Rafoth, Leal, & DeFabio, 1993). The relevance of information is the most important factor in transferring to long-term memory. The more relevant, the higher the rate of retention. Relevance can be determined by patterns. Students will see patterns and ask themselves “Why is this important?” and “Have I seen this before?” or “What is this similar to?” The more information presented in patterns, the more likely it is to be retained (Tileston, 2005).

Another factor in retaining information in the long-term memory is the level of original learning. The level of original learning predicts the degree at which information will be retained (Waters & Schneider, 2010). If the extra time is spent initially to learn more and approach mastery of information, then more information will be remembered over time. The brain seeks connections within its own history. New information wants to be attached to what is already known or experienced. When this connection happens, it facilitates a more complete transfer into long-term memory.

The rate at which information is retrieved is based on four major characteristics: association, similarity, critical attributes, and degree of original learning. Association deals with making personal connections to information. Emotional hooks to data that makes things personal and therefore more meaningful. Similarity refers to transferring information from memory based on similar situations in which that information is learned. Behaviors in one environment get transferred to another, in much the same way as pilots are trained in flight simulators to transfer those same behaviors in the future to real scenarios. Critical attributes are characteristics that make an idea unique. Retrieving information is easier when there are identifiable differences. Lastly, the degree of original learning (as previously mentioned) is more powerful to the mind and is not just an influence on retention, but
a major influence on recall. Learning to the point of mastery, not just covering a
general overview, builds stronger connections and makes for easier retrieval
(Tileston, 2005).

Chapter III
THE MIDDLE GRADES

Teachers start to expect a more mature approach to studying in the middle grades. In grades four and five, a mature understanding of how the memory and learning process works starts to appear. The middle grades mark a critical period in the instruction of study skills. These grades represent a transition between elementary and high school. Elementary teachers control learning time. During lessons, teachers will frequently monitor the progress of the class and provide direction as to which learning strategies will be best for each given subject or task. Conversely, high school teachers expect a greater capacity for independent learning. Students become responsible for organizing their time and allocating the proper amount towards studying. Furthermore, evaluations from teachers become few and far between as the teacher to student contact time becomes less and less (Rafoth, Leal, & DeFabo, 1993). In the middle grades, skills are being developed for independent learning but they are not quite at the level of being a fully independent learner. Further development is yet to be made, but the groundwork is set.

Students at that age are developmentally ready to become strategic learners. With an increasingly greater knowledge on how memory and learning occurs they are able to monitor their own learning and are able to adapt different learning styles without any teacher direction. Students are able to help themselves by setting learning goals, taking notes that would commit information to short term memory and then using study strategies to convert that information into long term memory.
Monitoring one’s own comprehension is rarely developed before 8 years of age. Young children often come across things that they do not understand, and before the middle grades they are often unaware that they do not understand. Learning how to learn is crucial. Building learning strategies makes for better outcomes on grades. Increased grades and knowledge of how to learn builds a positive self image that students are learners (Larkin, 2010). Pressley et al. (1987) found that fourth and fifth grade girls were more aware than boys that they were unlikely to be right on a challenging test. Boys are also more likely than girls to be oblivious to their past failures as they make predictions about future performances. After failing, girls make lower predictions about their performance based on their previous experience. If children are not made aware of their failures, its unlikely they will improve or make adjustments accordingly. The developmental differences between sexes, as they relate to memory and learning, are extremely hard to pinpoint. True to the nature of the middle grades, the development of both boys and girls are in an odd transitional period and make for a wide variability in their study skill development.

Not only are the brain and study strategies developing around the middle grades, but social pressures and responsibilities start weighing heavy. Middle school students experience a drastic upswing in their organizational demands: changing classes, using a locker, maintaining notebooks and folders for each class, remembering assignments and their due dates, managing homework from multiple teachers—all of which was previously maintained under the direction of an elementary school teacher. Most students in the 11–13 age range are in their final stages of dependancy. They are transitioning into formal thought “All students in the early middle grades are logical thinkers capable of reversing operations mentally and noting relationships between familiar concepts” (Rafoth, Leal, & DeFabio, 1993, p. 97).
They depend on known experiences to help them understand a problem and massage it into a solution. The challenge lies in guiding students to elaborate on things they are learning and organize their information in meaningful ways. The learning process leans more towards concrete demonstrations and informative images to help them learn best at this stage.

NOTE-TAKING

Beginning in the seventh grade, teachers increasingly rely on the lecture method of teaching. Students increasingly spend more time listening in a classroom environment—"About 50 percent of class time is allocated to listening to explanations, directions, and the like" (Rafoth, Leal, & DeFabo, 1993, p. 98). The most frequently preferred method of study for learning lectures is note-taking.

The process of note-taking is closely related to achievement. Given the proper training in note-taking, students will perform at a higher level. “Effective note taking doesn’t come naturally, it’s a skill that has to be learned” (Schlessinger, producer, 2005). Studies show students who were exposed to note-taking methods achieve A’s and B’s more frequently than those who are not (Sallie Mitchell, Public Relations, 2002). Higher grades have been linked to students who have proven to be good note-takers. (Carter, Hernandez, & Richison, 2009). Unfortunately, only half of 6th to 12th grade students have been taught how to take notes during the course of their academic careers (Sallie Mitchell, Public Relations, 2002). The absence of importance placed on note-taking can stunt a student’s ability to progress and succeed in future academic environments. Insufficient note-taking skills do not stop in the K – 12 setting; additional studies have recorded that as few as 11% of college freshman are able to record the critical ideas from their instructors’ lectures (Hartley & Marshall,
1974). Furthermore, more complete notes yield a higher achievement level (Rafoth, Leal, & DeFabo, 1993).

Note-taking methods are varied and highly customizable. One of the most revered methods known as the Cornell Method of Note-taking, was developed by Walter Pauk. The Cornell Method is widely regarded as one of the most comprehensive study tools because its promotes active learning and critical thinking.

There are 5 major stages within the Cornell Method: record, reduce, recite, reflect, and review.

1. **Record** refers to the actual note-taking process in which students will outline information and draw charts, diagrams, and illustrations in efforts to record the major points.

2. **Reduce** is the after class process of reviewing and condensing information. This step should take place as soon as possible, preferably with 24-48 hours. If conducted in a timely fashion, the memory has shown to be increased by upwards of 80%. This step revolves around recognizing keywords, phrases and questions that students might have while rereading their notes. Questioning notes is a great way to clarify ideas or help to elaborate on concept which will then make connections and improve memory. Summarizing notes promotes critical thinking because it should be done in the student’s own words. Summarizing commits information to short-term memory and eventually into long-term memory.

3. **Recite** is a focused studying stage. Its a time for self-testing and rewording information into one’s own words. Students can explain things to themselves or others in a social situation to help quiz themselves.

4. **Reflect** is the waiting time. It is the time period when short-term memory transitions into long-term memory. Students can use this time to draw their own
conclusions, relate concepts, make generalizations, or determine cause and effect, all of which are active critical thinking strategies which improve memory.

5. **Review** is the key to long-term retention of information. Reviewing information is a way to keep things fresh in mind. Conducting a distributed review, in which a student studies things several times over a length of time, is the most effective review. Reviewing things increases information retention and vastly decreases forgetting (Carter, Hernandez, & Richison, 2009).

Another note-taking technique that has proven to be effective in select settings is the use of mind mapping. Mind mapping is often a more illustrative way of taking notes in which students draw connections to like ideas through a hierarchical layout. This method is intriguing because it is a simultaneous stimulation to both sides of the brain. The left side of the brain has been said to house logic, lines, and words. The right side of the brain is responsible for colors, pictures, and curves. The engagement of both the left and right side of the brain increases the level of understanding, which in turn raises retention and speed of learning. Mind mapping requires distinguishing main ideas and details by making connections. Mind maps are great for seeing the bigger picture, increasing the capacity for complex data and dramatically increasing the level of concentration. The more concentration the less time needed to study and the more results are demonstrated. Mind mapping has been proven to be 3–10 times faster than writing linear, sequential notes. The important distinction here is that not everyone has a visual learning preference and would therefore not be able to employ this method. A distinct balance between the Cornell Method and select usage of mind mapping would cover the basis of most learning styles and subject matters (“Use Colours To Improve Memory Retention, Comprehension And Understanding,” 2010).
ATTENTION

Note-taking is more than just writing down things to be remembered. The note-taking ecosystem can be affected by a wide variety of things: emotions, attention levels, listening abilities, materials used, social implications, learning styles, writing skills, etc. All affect the memory, which is the key to learning, “There is no memory without learning and no learning without memory”.

The single most important aspect of improving memory performance is attention. The likelihood that information is absorbed and transitioned into long-term memory depends on how intensely one pays attention. The more attention paid to an experience the more it will be absorbed. Low attention levels will lower the understanding and clarity of information being delivered. The accuracy and efficiency of the memory system depends on how well the need for attention is met compared to the need to study. Other forms of attention have an effect on focus levels and productivity. Continuous partial attention refers to the problem in modern technology driven society that everyone is so busy keeping tabs on everything that they never actually focus on something. Interruptions wreak havoc on the short-term memory. The attention is so divided that there is no chance of building strong connections to the task at hand and therefore no memory being built while doing so. There may be one positive aspect to this, however—emotionally, people feel needed or desired when they are interrupted, makes them feel special or important (Thompson, 2005).

There are three major characteristics that influence attention and memory performance: memory tasks, the nature of the information that needs to be committed to memory, and what needs to be done to perform the task.
1. Physical and Mental state at the time. Student conditions are always fluctuating, the success of learning something while in a good mood will differ from that while tired or in a bad mood. Attitude towards performing the task is important. A positive or negative attitude will affect the desire to perform.

2. Performing the task alone or in a social setting. The presence of others often inspires students to perform quickly and more accurately. Often, students will work harder when they know other people are watching or may be affected by their actions.

3. Environment. Certain objects, signs, sounds, or odors can activate memories far better than other memory strategies.

4. Mental requirements. A task may require a small amount of processing of information or a great deal. The information may be completely new or well known. The presentation may be slow or rapidly paced.

5. Intentionality. The memory performance depends on whether one is intentionally or incidentally involved. When things are intentional, attention is deliberately paid to things that are important to remember. When things are incidental, attention levels are free to wander, and one may or may not remember without being aware (Herrmann, Raybeck, & Gutman, 1993).

**LEARNING STYLES**

Traditionally, there are three types of learners: visual, auditory, and kinesthetic. Visual learners are considered the majority of learners by a small margin. During a study session, visual learners tend to use a visual matrix style of recording their notes. Often known as mind-mapping, notes are constructed of shapes, colors, sketches, and pictures. These learners prefer to learn from books, pictures, maps, and diagrams.
There is an inherent difficulty with grasping and remembering specific facts and often a struggle with names. During a class, visual learners tend to watch the face of the lecturer while they attempt to imagine the details of the instruction. Auditory learners are best engaged while listening to, and discussing, information. They tend to make up 20% of the classroom. Lecture is their preferred instructional style, and consequently they perform well in the traditional school structure. Auditory learners might also be frequently called out in class for their love of talking, storytelling, and desire to laugh. Kinesthetic learners perform best when movement and touch are closely involved in the learning process. There is a fundamental reason for increased performance with kinesthetic learners, i.e., “thinking on your feet”. Movement, or at the minimum standing, promotes blood flow to the brain and helps with cognitive processes. Students who are kinesthetic tend to be the athletes in class and respond quite well to rewards (Tileston, 2005). The task of every educator is not necessarily to teach to these different learning styles, but to have an appreciation for them. Having respect for learning preferences in which students are more engaged and comfortable digesting new information can make for a more effective learning experience.

Education is a never ending process. People of all ages are still students in one form or another. The development of study skills and strategies builds throughout childhood and becomes increasingly more important through the middle grades, into high school, and college, and finds its way into the daily lives of adults. Understanding the foundation of the learning process, how the brain works, how memories are formed, and what external and internal factors affect these things can only strengthen people as learners. Progressing past this understanding and constructing something actionable to aid students in taking advantage of this knowledge and driving their learning process to new levels is the task of this thesis.
Chapter IV

THE RESEARCHABLE QUESTION

How can the design and creation of comprehensive note-taking tools improve middle school students information recall and retention?

With a solid understanding of how middle school students process information, additional questions arose:

1. What tools can be developed to help students not only take notes but monitor their learning and improve long-term memory?
2. What note-taking methods are proven to be effective?
3. With considerations to external and internal influences, what additional features should be incorporated with note-taking tools to improve the overall experience?

ASSUMPTIONS

A set of expectations was developed prior to the completion of secondary research and formulated plans for primary research. Based on a significant amount of literature review and personal experiences the following assumptions were made about the targeted middle school student user group:

- The majority of students were never taught formally how to take notes.
- Students who were taught how to take notes have a history of performing at a higher level academically.
- There is a right way and a wrong way to take notes based on subject.
- Memorization is the key to the studying process.
- Most students study by rereading their notes over and over again.
• The majority of left handed students are visual learners.
• Girls are much more organized and neat with their notes.

Chapter V

PRIMARY RESEARCH

In designing for people there is always a concern with how to handle uniqueness. Every user is unique. Based on secondary research, initial methods of identifying users were developed:

• Gender
• Age or grade level
• Average Achieved Grade (A, B, C, D, & F)
• Learning styles; visual, auditory, and kinesthetic
• Whether or not they were formally taught how to take notes
• Study habits
• Preferences of handwritten or electronic note-taking

These initial user characteristics helped inform the creation of the survey questionnaire later used in this study.

ETHNOGRAPHIC RESEARCH

Ethnographic research was conducted to gain a first person perspective and context on the environment of the middle school student. Environmental context is closely related to behavior (Rosenfeld & Morville, 2002). Ethnographic research borrows from anthropology in that it involved observing users in the place where they would normally use note-taking tools. The observation was meant to gather data about who the target users really are, what tasks and goals they may have that relate to the tool in development, and the context in which they work to accomplish their
goals. The goal for pursuing ethnographic research was to conduct qualitative research that can help develop user profiles, personas, scenarios, and tasks that will inform crucial design decisions throughout the development of the note-taking tools (Rubin & Chisnell, 2008). Research was conducted in seventh and eighth grade classes at Saint Sebastian Parish School, a catholic school located in Akron, Ohio. After confirming the intent of the research, Mr. Allyn Rose volunteered his Social Studies class to participate in this study.

The study took place during two hours of lecture in a seventh grade classroom. Observations were made from the bordering walls of the classroom so as to not interrupt the natural flow of the lecture or create any unnecessary stress on the students. Seeing the students’ workspaces was valuable in knowing the range of resources available and the method in which they were used. Simply observing the students perform their daily tasks provided insight on how this research’s deliverable could help students be more productive. New information was introduced, especially in the realm of the students’ environment and working conditions.

Observations:

- The room was dark in order to project slides on the wall during instruction.
- Lighting seemed to be frustrating; there were a lot of squinting and sighs of frustration while trying to take notes and read textbooks.
- The workspace used by the students was limited. Approximately two feet of desk space was available for notebooks, textbooks, supply boxes, binders, and folders.
- Students were hunched over in their chairs trying to get a closer look at their notebooks in the dark and articulate their body to better write. Using a notebook seems to force bad posture. Most students had their face six inches away from their notebooks.
• Girls are much neater and more organized with their notes and layout of their workspace.

• Notes were comprised of a mixture of phrases, bullet points, drawings, charts, and graphs.

• Color was used in some notebooks in the form of highlighters, colored pens, and pencils.

• Students either compiled their notes into a single notebook or gathered loose paper into a binder or folder.

SURVEY

Surveys have proven to be a broad and shallow research tool in terms of the amount of information that may be gained. They provide an opportunity to gather large amounts of information relatively quickly. In this research scenario, surveys have been used to identify the target demographic and the ecosystem of learning, note-taking, and studying within a middle school class environment. The surveys were constructed with respect to the ethnographic research that was conducted and the initial assumptions based on literature review and personal experiences.
Surveys were administered to the students in the classroom under the supervision of their teacher two weeks after the initial ethnographic research. The tone used throughout the survey was intended to reach an 11 – 13 year old audience (instead of asking their sex, the survey read “Are you a boy or a girl”, etc...). The order of the questions was organized in a way that would ease the participant into the more challenging and important questions. Providing “softball” questions earlier on and progressing to the more self reflective questions towards the completion of the survey helped in that cause.

The following is a list of the survey questions asked in the questionnaire.

1. How old are you?
2. Are you a boy or a girl?
3. What grade are you in?
4. Do you use your left or right hand to write?
5. What grades do you usually get in school? (Check one)
Mostly A’s
Mostly A’s and B’s
Mostly B’s
Mostly B’s and C’s
Mostly C’s
Lower than C’s

6. It’s easier for you to learn something new when... (Choose up to 2)

- shown a lot of pictures and charts
- lots of reading and details
- listen to a lecture or a recording
- get to work with my hands
- other (please describe) additional writing space was provided for this answer

7. Do you take notes in class?

8. Have you ever been taught how to take notes in school?

9. If you answered yes to the previous question, when? What grade?

10. Do you take notes with an electronic device or a notebook? Which one?

11. When you go back and look at your notes, do they help you remember the information?

12. When I’m studying I usually...

- reread my notes over and over
- make flash cards
- rewrite my notes
- other (please describe) additional writing space was provided for this answer

The user research compiled from survey data served as a mass of information that could be synthesized and segmented to understand the preferences of a broader base of users. Furthermore, these surveys helped in validating or debunking the initial
assumptions of how to segment this user group. From 73 participants, the following data was compiled: (*Please note, not all questions were answered by all 73 participants.*)

## RESULTS

<table>
<thead>
<tr>
<th>Average Age</th>
<th>Female</th>
<th>Male</th>
<th>Left Handed</th>
<th>Right Handed</th>
<th>Both Hands</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>52%</td>
<td>48%</td>
<td>7%</td>
<td>92%</td>
<td>1%</td>
</tr>
</tbody>
</table>

Table 1. General background of survey participants.

The data represented was nearly split down the middle. The numbers dictated that the tools developed need to be designed with consideration to both sexes equally with a primary consideration for right handed usage.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>26%</td>
<td>52%</td>
<td>4%</td>
<td>12.5%</td>
<td>4%</td>
<td>1.5%</td>
</tr>
</tbody>
</table>

Table 2. Achievement levels of survey participants.
An overwhelming 78% of students are achieving at least a B on average in their classes. The data suggested that most of the students who participated are good students who are used to achieving high levels academically. This data became more relevant when compared to learning styles and study habits.

![Bar chart showing achievement levels of survey participants.]

Table 3. Learning preferences of survey participants.

<table>
<thead>
<tr>
<th>Learning Style</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pictures and Charts</td>
<td>23%</td>
</tr>
<tr>
<td>Reading and Details</td>
<td>28%</td>
</tr>
<tr>
<td>Listening</td>
<td>17%</td>
</tr>
<tr>
<td>Work with Hands</td>
<td>25%</td>
</tr>
<tr>
<td>Other</td>
<td>7%</td>
</tr>
</tbody>
</table>
The “other” responses noted that they learned best when things were explained to them over and over again or if they took good notes. A few responses were redundant and merged with the rest of the related categories.

The data suggested a need for a full featured tool that covers all learning styles: visual, auditory, and kinesthetic. Each style was very closely recorded within 11 percentage points of each other. The visual category was broken into “Pictures and Charts” and “Reading and Details” because taking notes on those visual ways of learning are vastly different and require a variety of tools. Despite the separation of the visual learning style into two halves, the data still represented itself near equally and further solidified the need for visual considerations.

Figure 3. Whether they take notes or not.

Nearly all students responded that they take notes during class.
Figure 4. Whether they were taught how to take notes.

Contrary to the statistic cited previously (informed by literary review) that only half of 6th to 12th grade students have been taught how to take notes during the course of their academic careers (Sallie Mitchell, Public Relations, 2002), 99% of these students claim to have been taught how to take notes at different grade levels.
The major grades in which students have been taught how to take notes peaked in the middle grades, which is ideal for child strategic learning development and transitional periods in education instruction styles. This data may also speak to the fact that the majority of participating students are achieving at a high level, previous grade history would have to be explored to make a more solid connection.

**PERSONAS**

To gain a better understanding of the user group that should be targeted, user personas were developed. Segmentation was performed on the basis of patterns that became apparent when comparing survey responses. Separating users into three major groups helped focus development and held the design accountable to a variety of user considerations. The patterns that emerged were learning styles and grade achievement levels. Upon comparing the two, the survey data suggested that the
within each type of learning style, the majority of students achieved specific levels of grades:

- Kinesthetic learners achieved “Mostly A’s and B’s”
- Visual learners achieved “Mostly A’s”
- Auditory learners achieved “Mostly B’s and C’s”

User goals include using note-taking methods to learn new concepts and retain those concepts, a reference for later use in studying, and the end result of achieving a quality grade. Because this research informs the development of a service that people will use, focus was placed on attributes that reveal how people will actually use the service. Behaviors (how the user does things) and attitudes (how the user perceives what they are doing or how they perceive themselves) were the major areas of interest (Mulder, 2006).

Personas work best when they bring to mind real people. Each persona has been assigned an image and a name to more effectively reference the user and breathe a sense of reality into each. A generalized bio that quickly describes the user was also applied for a more efficient “at-a-glance” functionality of the overall difference between user groups. Further user background information was fabricated to apply different scenarios to each persona and give a more realistic representation of each group.
These personas serve as a check and balance of the design and development of the note-taking tools. Throughout the stages of the design, the personas were taken into consideration in regards to usability, features offered, and tone.
The classroom at St. Sebastian is well equipped with technology to help the instructional process. Mr. Allyn Rose had access to a full featured smart whiteboard that would allow him to draw and interact with his presentations. There were speakers mounted on all sides of the classroom for school wide announcements in the morning could also be used during class to project Mr. Rose’s voice more effectively to the entire class, alleviating a need to raise his voice or worry that some students may not be in a good position to hear him. The standard projection screen and computer system were also available.

Technology in the classroom is important to modern societal norms and making use of it keeps school in tune with modern culture. The biggest advantage of technology is that its not limited by classroom walls. Not only is it a window to a wealth of knowledge, but students go home to technology and have continued access. Computers are a great equalizer— they can level the playing field in terms of socio economic differences between children and their families. The internet, whether accessed from a 10 year old computer, a friend’s laptop, the public library tech stations, or a fresh off the shelf state of the art machine, is an equal opportunity resource. With an internet connection, everyone is equal. Technology is a real world tool. Hiding a classroom from the real world would lesson the ability for students to compete and pave their own way once they are done with school (Tileston, 2005).

The latest revolution in educational technology is the iPad, a touch screen tablet computer. Applications run on the iPad which provide it with a wide range of abilities; watching movies, reading books or magazines, playing games, taking pictures or movies, audio recording, drawing, writing (both typing and handwritten), and a full feature web browser, just to name a few. Though the iPad has only been out
for two years, studies have already started to favor it as a learning tool. Students using iPads have been shown to score higher and perform more efficiently than their paper-based peers. Approximately 50–60% of students from the Chicago public school system have shown gains in reading, math, and science in classes with iPads (Ong, 2011). Of those students who own tablets, 73% prefer it to traditional books and 86% feel that it helps them study more efficiently. The iPad’s momentum does not show any signs of slowing. In 2011, 48% of college students thought that tablets will replace books in the next five years (“Pearson Foundation Survey on Students and Tablets,” 2011).

Figure 7. Taking notes in notebooks or with electronics.

Of the students surveyed in this study, 96% use notebooks for their notes and only four percent have recorded a use of electronics and notebooks. This data presents an opportunity to adapt technology in the classroom and take advantage of its features.
The iPad presents a change in the way students can use technology to help their learning process. The ability to type out notes has been around since the advent of laptops or computer labs in classrooms. The iPad continues the typing ability to take notes but also presents the traditional handwritten option in electronic form. This capability solves a lot of concerns that students and educators have had with typing notes out; writing has shown to be a more engaging way of taking notes and has proven to promote memory. Writing requires use of the hand, which in turn exercises the brain a bit more while trying to form the shapes of the letters. From a biological standpoint, writing stimulates the cells at the base of the brain. This stimulation is called reticular activity. The reticular activity system acts as a filter for what the brain needs to process. More importance is given to things that the person is focusing on—a physical act of writing brings that focus to the forefront of the mind and increases brain activity, and increased brain activity is always a benefit to memory. Children’s writing abilities have shown to be better while using a pen or pencil. While physically writing, children write more, faster, and with more complete sentences. Students have proven even further that while drawing or writing shapes, they have a easier time learning them as compared to typing. Writing boosts learning and goal achievement. People who write down their goals and share them with others to help maintain accountability are 33% more likely to achieve their goals versus those that just make goals (Pinola, 2011). This raises another technological advantage of the iPad’s sharing.

The iPad, being an internet ready device, has many opportunities for social interaction. A social element to achieving goals is just the beginning. The Secretary Commission on Achieving Necessary Skills (SCAN) maintains the stance that reading, math, and writing are important but the most important marketable skill is
the ability to work with others. Within a classroom setting there are two necessary communications, between the student and the teacher, and between student and student. These interactions work on multiple levels. “It’s one thing to know, it’s another to explain to others” (Tileston, 2005, p. 62). Students have shown to learn best when teaching something to someone else. Keeping engaged in these interactions promotes higher-order thinking in which students can apply ideas, form generalizations, and raise questions. A byproduct of increasing social skills, there is a solidifying of learning through discussion of what has been said in class, formulating questions, and using information in new ways (Tileston, 2005). Information retention is increased during these interactions, and the more ideas that are socially inline with other peers the more likely one is to retain the information (Herrmann, Raybeck, & Gutman, 1993). There is an element of cooperative learning within these environments. Students observe different levels of mastery in a variety of areas and begin to reflect on their own knowledge. Students reassure their confidence that those levels of mastery are possible. Peers provide support and assistance to one another. Explanation of study strategies in their own words can go a long way in building memory (Rafoth, Leal, & DeFabo, 1993). Having a surrounding support group of peers can foster growth within each other, sometimes referred to as proximal development. Adults and advanced children can help struggling students master skills they normally could not (Waters & Schneider, 2010).

In the data collected through surveys, there were options to denote student study habits. The provided habits proved to be major categories, but the “other” option was the second most used selection.
Of those students that answered “other”, 83% stated that they quiz themselves or had their friends and family members quiz them in one form or another. An even deeper look into the data shows that 93% of those students who suggested they study through quizzes were in the “Mostly A’s” or “Most A’s & B’s” level of achievement. As previously stated the social interaction with peers, advanced children, and adults can drive a student’s work to higher levels, and the concept of quizzing is at the heart of well received note-taking processes.

Chapter VI

NOTABLE

Key decisions were made with respect to the research presented thus far. The most effective way to achieve a “comprehensive note-taking tool” is to employ the feature set of the iPad and its growing track record as an educational tool. The iPad can cater to the needs of all learning styles.
• **Kinesthetic**— The major feature of the iPad is its a multi-touch screen operated by common gestures and human interaction. Kinesthetic learners will be engaged at multiple levels, not to mention the possibilities of going mobile and actively using the device on the go.

• **Auditory**— The iPad supports not only built in audio output, but recording capabilities.

• **Visual**— The iPad features a high resolution screen, boasting better clarity than the average big screen television. The immersive graphics and ability to video record from its HD camera and high resolution camera are huge assets.

With respect to note-taking styles, the iPad technology can support the traditional keyboard experience as well as the traditional hand written experience. Although the data is mixed between the efficiency of the keyboard and the brain stimulating advantages of handwritten notes, the iPad can accommodate both. The proven note-taking methods mentioned in this research can both be fully conducted through organized Cornell outlining and Mind Map free form drawing and illustrative connections.

The accessibility to the internet and the wave of options in the social network realm top off the major features that the iPad makes possible in one device.
BRANDING AND IDENTITY

The major features of the iPad app are note-taking, quizzing, and social interaction around learning. *Notable* is the name of the app, inspired by its relation to “notes” and the meaning of something important or worthy of distinguishing. The branding and identity around Notable is meant to invoke the concept of “tie a yellow ribbon”, both as a concept of a way to remember something and the common use of a ribbon like symbol as a bookmark. Additionally, yellow is a color often associated with activating the mind because of its high contrast and associated use with way-finding and caution (Carter, Hernandez, & Richison, 2009).

Figure 9. *Notable* branding / identity.
WIRE-FRAMING AND SKETCHING

The interface was conceived through an iterative sketching process. Concepts were developed with consideration to the overwhelmingly right-handed user group, existing iPad design conventions, and easily recognizable icons.

Figure 10. Login wireframe.
Figure 11. Notes library wireframe.
Figure 12. Sidebar and keyboard layout wireframe.

Figure 13. Fullscreen typing wireframe.
Figure 14. Freeform and mind mapping interface wireframe.
Figure 15. Mind mapping tools, shapes and size preferences interface wireframe.
Figure 16. Social profile version one wireframe.
Figure 17. Social profile version two wireframe.
USER TESTING

Further interface development was explored in electronic form using Adobe Illustrator. After an initial prototype was developed, user testing was conducted on the interface and general use of Notable. The test included five participants, two boys and three girls. User testing has been proven to show the best results from testing no more than five people. After the fifth user, one notices that they are observing the same findings repeatedly and not learning anything new (Nielsen, 2000). These middle school students were presented with version one of the Notable prototype and asked to navigate from page to page while openly giving feedback. The following pages are the areas of the prototype that contained confusing elements, which were later addressed.

Figure 18. Features introduction page.
Figure 18 is the “Getting Started” page of Notable, intended to give the user a brief overview of the app’s features and familiarize him with the three major interface elements, Notes, Quiz, and Assembly. These three icons are used throughout the app to navigate to those three major features. The Quiz icon was often hard to understand and not readily associated with quizzing. Each user stumbled on its purpose, and some offered alternate ideas as to what it does, “might mean save?” After the repeated trouble, this screen and all uses of the quiz button were revised.

Figure 19. Features introduction page, revised.

The revision utilized a quicker read of “Quiz” with the reinforcement of the letter “Q”. Additional style revisions were made by removing the drop shadows behind all of the icons to better match the rest of the interface. The use of the term “Assembly” was initially a driver to user test this screen. The term was consistently understood and
recognized with social, group, and friend connotations. The term assembly draws from the student’s existing experience in school and his school wide gatherings for announcements, pep rallies, etc.

The next usability concern that was raised unanimously by all test participants was the naming of the freeform and mind mapping function in the app settings.

The terms were not used with consideration to the demographic and were changed to a more simplified and obvious name, “Writing + Drawing”.

The last major concern for users was a navigation issue. The users had the chance to take notes in multiple forms. Once inside a specific style, the ability to navigate back and forth to other styles was crucial to the comprehensive experience. Once in any given note-taking style, there was no navigational element to go back to
“typing”. In Figure 21, in the center of the screen under the yellow ribbon is the main navigation of note styles; no typing option was initially represented.

Figure 21. Writing and drawing area, lack of navigation back to the typing method of notes.
THE INTERFACE

The overall interface, as seen in Figures 20 – 22, is based on web standard layouts. The primary navigation is across the top, which adds additional buttons when the user is in different sections of the app. The three major app icons are always present and located in the same place to maintain consistency. The left side navigation pops out when needed to delve deeper into different saved note areas or social settings within the “Assembly” portion of the app. The primary left aligned layout takes advantage of the top to bottom and left to right reading styles of the users, as is customary in all users in the western hemisphere. The familiar F-shaped pattern formed by the left panel and the top navigation refers to a dominant reading pattern that most users take while browsing a website (Nielsen, 2006). Taking advantage of existing usability habits only strengthens the app’s functionality and
can increase the ease of adopting this app into daily workflows. The use of the yellow ribbon throughout not only reinforces the brand, but acts as a landmark for the users to quickly get their bearings as to where they are in the app. The direction and proximity and placement of the ribbon in select places helps drive the user’s eye into areas of importance. The monochrome color palette is strategically used to place a focus on the user’s content. The app itself does not need attention, its a tool meant to aid in generating content. In this case content is truly king.

Chapter VII

NOTABLE WALKTHROUGH

Figure 23. Log in screen.
Figure 24. Log in screen with keyboard active.
Figure 25. Get started.
Figure 26. Notes homepage.
Figure 27. App settings.
Figure 28. View completed notes.
Figure 29. Note-taking process (typing).
Figure 30. Note-taking process (typing) full screen.
Figure 31. Word pop-up.
Figure 32. Font color options.
Figure 33. Writing and drawing Mode.
Figure 34. Illustration color options.
Figure 35. Brush thickness option.
Figure 36. Shapes tool and mind mapping example.
Figure 37. Assembly profile.
The brain has an innate learning process. When successfully learning, the brain produces pleasure chemicals, serotonin, dopamine, and endorphins. These chemicals are key factors in feeling satisfied and rewarded, all of which influence motivations. Students have an inborn motivation to learn. Learning is rewarded from that motivation with a pleasurable feeling (Smilkstein, 2003). “We don’t just compute, learn, reason, and know. We are driven to do all these things and are designed to take intense pleasure in doing so” (Smilkstein, 2003, p. 107). Understanding these chemicals and their effects on learning, Notable makes use of badges within its social structure to help with positive reinforcement and give the students an incentive for continued use beyond improvements in achievement levels.
Figure 39. Assembly news feed.
Figure 40. Assembly private messages.
Figure 41. Assembly friends.
Figure 42. Assembly chat sessions.
Figure 43. Quiz menu.
Figure 44. Quiz taking process.
Persistent rewards affect student performance (Bligh, 2000). Maintaining a positive learning environment goes a long way towards motivating and driving student performance to higher levels. Making use of positive pop-up messages that reinforce a “Great job” is one way that Notable continues that positive atmosphere.
CONCLUSION

*Notable* is a versatile tool that functions in varied note-taking environments. Considerations for different learning styles and activities that aid in information retention and recall are uniquely utilized throughout the application. This thesis offers a framework for the development of *Notable*. Ethnographic research was conducted on middle school students to gain insight into their learning environments, including the classroom, lecture styles, note-taking tools, organizational methods and social interactions amongst teachers and classmates. Quantitative research was conducted in the form of a survey. Over 70 participants submitted answers to questions revolving around achievement levels, learning styles, tools, and study habits. Data synthesized from surveys informed the construction of
user personas and usage scenarios to help focus an iterative design approach toward the development of a comprehensive note-taking application.

Further developments are under consideration that would integrate instructors and parents into this application. Guided note-taking from teachers that is specific to class goals could be the next step into higher levels of information retention and recall. Guided notes have shown students to be focused more on the task at hand rather than writing, with up to 20% less writing per 50 minutes of lecture (Carter, Hernandez, & Richison, 2009).

After successful coding and product launch, continued user testing in real classroom scenarios will prove to be most useful in determining the next steps for Notable. With a researchable track record, a wider scale launch of the application can be set into motion and truly embody a comprehensive note-taking solution.
REFERENCES


cefc1&ex=1287115200&partner=rssuserland&emc=rss&pagewanted=all

