THE TUTOR’S EXPERIENCE: A CASE STUDY OF USABILITY & USER EXPERIENCE IN TUTORTRAC

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Thank you to my advisor, Tim Huang, for stepping in and helping me limp across the finish line. Your guidance and endless patience were exactly what I needed to complete my thesis. Thank you for being such a caring and attentive mentor.
Abstract

THESIS: The Tutor’s Experience: A Case Study of Usability and User Experience in TutorTrac

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This research examines the effectiveness of the TutorTrac web-based application by conducting a usability and user experience case study. TutorTrac is a management application designed to provide “on-demand access to essential tools, such as appointment scheduling, logging visits, and activity reports” (TracSystems, 2019). In this case, I focus on evaluating the scheduling function, because it is the primary task TutorTrac performs at the Ball State Learning Center. After gathering heuristic data from surveys and an eye tracking study, I analyze the ease of use, efficiency of task performance, and employee satisfaction when using TutorTrac. The objective of this document is to answer the following questions: 1) What are the usability problems in TutorTrac?, 2) what emotional impact does TutorTrac have on potential users?
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Chapter 1: Introduction

I was initially employed at the Ball State (BSU) Learning Center in 2016 as a Supplemental Instructor (SI) for a History 150 class. “SI is an academic support program designed for large lecture classes or classes with a high failure and withdrawal rate. An SI leader is a student who has already taken the class and been trained in academic assistance” (Ball State University). They attend the class, take notes, and then host study sessions and design review material for that specific class. I later made the transition to tutor and, eventually, to graduate assistant. The Learning Center offers a wide spectrum of services including tutoring, writing assistance, testing, and study skills education. The Learning Center staff work in collaboration with many other offices on campus regarding academic success, including Student Athletic Support Services, Disability Services, and the Counseling Center.

During my time as a supplemental instructor, tutor, and graduate assistant, one common concern was consistent in my daily life: complaints about the center management interface. TutorTrac was a recurring subject amongst both student staff and administration. Would we discover a new glitch today? Would the server go down and leave our screens frozen and unable to add or cancel appointments? How does one even get to that screen? What did we enter wrong this time in the system? The frustration and exasperation with the application was so extreme that my supervisors were immediately enthusiastic when I suggested the idea of doing my thesis on the efficacy of TutorTrac. The following study is an exploration of the usability of TutorTrac which aims to improve understanding of the user experience and diagnose flaws in interactions between the user and the interface.

History of the Ball State Learning Center
Since its establishment in 1985, the BSU Learning Center (LC) has been an integral part of academic support services for students. As a component of the first University College in Indiana higher education, the LC was initially created to administer services to students enrolled in developmental courses (Spalding, 1985). At the time, Indiana was struggling to preserve freshmen enrollment; about twenty percent of students dropped out prior to beginning their sophomore year (Meyers Sharp, 1985). In a state where only forty-eight percent of high school graduates matriculated to college, Ball State University discovered a distinct need to extend assistance for basic skills remediation (North Metzger, 1985). The BSU LC was thus created to “improve students’ academic levels and retention by implementing an intensified advising and tutoring service,” (Spalding, 1985, p.1). However, this objective soon changed as it “became clear that students at all levels of academic preparedness chose to seek out [Learning Center] services” (Haley, 2018, p. 1). Since its first year, the LC usage has continued to steadily increase. From 1985-1986, the LC served 1,200 students in peer tutoring and workshop sessions (Haley, 2018). From 2017-2018, the LC “supported 16,010 tutoring sessions, 13,502 SI visits, 185 Academic Coaching visits, and proctored 1,918 exams” (Ball State Learning Center, 2018, p. 3).

With such a high demand for service, administrators at the BSU LC quickly realized the need for organizational help. Prior to 2014, the four separate tutoring desks—General Studies, Math, Writing, and Reading/Study Skills—used a “native system to track usage, and each of the four separate desks used their own scheduling systems” (Haley, 2018, p. 1). In 2014, the LC purchased an outsourced, web-based application by Redrock Software Corporation, intending to streamline the scheduling process and record visits. This application, TutorTrac by TracSystems, is advertised as “the complete management solution developed for the specific needs of learning, writing, tutoring, academic skills and other centers that support students in higher education”
Though TutorTrac was initially perceived as an innovative solution for the BSU LC, the novelty of the software was soon eclipsed by concerns such as the rapid turnover rate of staff, the lack of effective training materials available from the software company, and the frustration new users expressed while attempting to navigate the interface.

**History of TutorTrac**

Redrock Software Corporation, the creator of TracSystems, was founded by Kelly Dean Corder in 1991. This business is a software development company located in Mesa, Arizona. One of their main marketing appeals is the customizable nature of their software, which can be tailored to a client’s needs: “Through cooperation with our clients, we are able to provide a unique approach to maximize development resources and allow for flexibility in design and function” (TutorTrac, 2019). In 1995, this young company recognized an opportunity to expand into the education market and released a software package for educational management. Five years later, Redrock identified a new target within the education system and launched TutorTrac to assist with management and booking in centers for tutoring, writing, and academic skills. Today, Redrock has expanded into several different industries and is responsible for software beyond the educational market (TutorTrac, 2019).

According to Redrock, TutorTrac is one of the leading software products for collegiate Learning Center management. Laura Reed, the TutorTrac Sales Manager, shared that they currently have about 525 active clients in the collegiate market. Similar to most modern software services, TracSystems has a hierarchy of subscriptions for their various levels of service. The term “active client” refers to the clients who pay for the annual support agreement, which provides access to training, tech support, upgrades, and updates. There are possibly more universities and colleges that use TutorTrac, but these are not accounted for because they
stopped renewing their support agreements. Figure 1 shows a breakdown of the TutorTrac products and prices.

Table 1.

TutorTrac Services and Prices

<table>
<thead>
<tr>
<th>Package</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lifetime license <em>(Mandatory)</em></td>
<td>$2995</td>
</tr>
<tr>
<td>Annual Support Agreement (training, tech support, upgrades, and updates)</td>
<td>$899 <em>(1st year mandatory)</em></td>
</tr>
<tr>
<td>Redrock hosts software for you</td>
<td>$2500 (1 time for life of server) and $1200 (per year for actual hosting)</td>
</tr>
<tr>
<td>SAGE Modul – early warning alert system</td>
<td>$1995 (Modul) and $200 (per year)</td>
</tr>
<tr>
<td>Whiteboard Module – virtual classroom for online study sessions</td>
<td>$1695 (Modul) and $100 per year</td>
</tr>
<tr>
<td>SurveyTrac Module – survey creation and delivery system</td>
<td>$695 (Modul) and $50 per year</td>
</tr>
<tr>
<td>TextAlerts Module – can send notifications to students via Text</td>
<td>$695 (Module) and $75 per year</td>
</tr>
<tr>
<td>MobileView Module – can view Trac System from Mobile Device/Tablet</td>
<td>$695 (Module) and $75 per year</td>
</tr>
<tr>
<td>Starfish Module – Exports visit data into set format that is accepted by Starfish</td>
<td>$695 (Module) and $50 per year</td>
</tr>
<tr>
<td>Q2 Tables – Allows management of Study Tables</td>
<td>1st Q2 $995 and $50 support</td>
</tr>
<tr>
<td></td>
<td>2nd Q2 $295 and $50 support</td>
</tr>
</tbody>
</table>
Jennifer Haley, the Director of the BSU LC, asserted that TutorTrac’s popularity was one of the reasons they chose to purchase the license. Unfortunately, it is difficult to investigate whether TutorTrac’s claim about its prominence is accurate because of the decentralized nature of learning centers. Most institutions of higher education have academic support services, but they may not have a consolidated learning center. Some institutions offer tutoring through individual departments, while others may only offer proficiency skills coaching for subjects such as writing or study techniques. Though there is no current census data on how many collegiate learning centers exist in the United States, we can use the National College Learning Center Association’s (NCLCA) roster of membership to get an idea of what TutorTrac’s 525 active clients may represent against the national authority on learning centers. The NCLCA defines learning centers at institutions of higher education as:

Interactive academic spaces which exist to reinforce and extend student learning in physical and/or virtual environments. A variety of comprehensive support services and programs are offered in these environments to enhance student academic success, retention, and graduation through applying the best practices of student learning theory and addressing student-learning needs from multiple pedagogical perspectives. Staffed by professionals, paraprofessionals, faculty, and/or trained student educators, learning centers are designed to reinforce the
holistic academic growth of students by fostering critical thinking, metacognitive development, and academic and personal success. (NCLCA)

Currently, the NCLCA has members from 513 institutions. There are about 4,313 institutions of higher education in the United States today, meaning that the NCLCA only represents about 12% of the total number of institutions of higher education in the U.S. (Duffin, 2019). TutorTrac boasts 525 active clients, which means that they have more membership by institution than the national authority on learning centers. With learning centers being so diverse across the board and dispersed in operation, it is safe to say that TutorTrac holds an impressive amount of the customer base. In terms of this research, this paper will be examining one of the leading technologies for this niche market.

One consideration that could contribute to TutorTrac’s prominence is that it is one of only a few companies that currently have significant market share of learning center specific management software. If homegrown management systems are not taken into account, TutorTrac has only two big commercial competitors: WConline and Accutrac. According to Reed, “none do as much as TutorTrac at the price we have.” WConline, for one, is a very simplified version of what Tutortrac offers; it still has scheduling and reporting functions but offers less detail and support options. Accutrac is on the same level as TutorTrac in terms of complexity of design, but it does not offer the extensive reporting and scheduling capabilities that TracSystems boasts. By all accounts, TutorTrac appears to offer the most accessories.

Overall TutorTrac appears to be one of the top options amongst learning center management software. Though this niche market is low on providers, when compared with similar software TracSystems does offer the most services for competitive pricing to a significant amount of the reported clientele. However, concerns have been raised about the customizable
nature of TutorTrac. While it is a great asset to be given a wish list of needs from clients, it would be an oversight to simply design exactly what a client requested without taking into account the usability of a product. It is the designer’s responsibility to see beyond the client’s desires and consider the practicality of a design for the primary user and particular environment. At the time of this research, TutorTrac representatives were unaware of any user research conducted on the TracSystems software.

**Purpose of Research**

As I mentioned above, learning center management software may influence lots of users. However, only few studies to date investigate the impact of the design on users. I identify whether TutorTrac is an effective scheduling tool for the BSU Learning Center in terms of ease of use, efficiency, and employee satisfaction. My research objectives are to investigate what areas of the TutorTrac design could be improved and identify what emotional impact TutorTrac has on users. To do this, I examine the following questions: First, what are the usability problems in TutorTrac? Second, what emotional impact does TutorTrac have on potential users? At the end of this research I will also come up with recommendations for improving TutorTrac’s user experience.
Chapter 2: Literature Review

This literature review will define usability as a concept, and briefly discuss how usability has transformed over time. It will also examine previous usability research in learning centers, specifically analyzing two case studies that are similar to this research. Finally, this section will define and explore heuristic evaluation as a method for usability research, and outline Jakob Nielsen’s 10 Heuristic Principles.

Previous Research on Learning Centers and Usability Studies

Over the last thirty years, usability has risen into one of the top applied concepts in human-computer interaction research. Steve Krug, author of Don’t Make Me Think Revisited, reported that one of the reasons he released a revised edition of his book was due to usability slipping into the mainstream:

In 2000, not that many people understood the importance of usability. Now, thanks in large part to Steve Jobs (and Johnathan Ive), almost everyone understands that it’s important, even if they’re still not entirely sure what it is. Except now they usually call it User Experience Design (UXD or just UX), an umbrella term for any activity or profession that contributes to a better experience for the user. (p. 115)

In the 1980s, usability mainly focused on judging and improving the quality of computer systems but, over time, has expanded into other contexts like home technology (Peterson, 2002), cosmetics (Bhatti, 2010), and urban planning (Ståhle, 2010). In order to transport the concept of usability across such diverse fields, experts have crafted many definitions. Shackel’s framework (1991) defines usability as the capacity to be used by humans with ease and efficiency. Bevan’s definition (1995) shortens usability into the “quality in use” (p. 115). Steve Krug (2014)
describes a product as usable if “a person of average (or even below average) ability and experience can figure out how to use the thing to accomplish something without it being more trouble than it’s worth” (p. 8). More recently, de Almedia Pacheco et al. (2019) claimed that for a product or service to be usable, they “must be useful, efficient, effective, satisfactory, easy to learn, and accessible” (p. 3). All the definitions revolve around how effective a system is at meeting a user’s needs, how quickly those needs are met, and how satisfied a user is with the experience.

One of the contexts into which usability has been more recently introduced is learning centers. Previously, the discourse in this field has focused predominantly on tactics for building or bettering learning centers, such as increasing student usage, strategies for improving tutoring, and increasing support for academic support services. This includes, but is not limited to, subjects such as retention or intervention programs (Navarra-Madsen, 2010), recovery for at-risk students (Rheinheimer, 2012), diversity outcomes (Hosapple, 2012), and the effectiveness of peer tutoring (Munley, 2010). However, some researchers have begun to see the benefits of applying usability to subjects in learning centers and started employing user testing to academic support technologies.

In her 2015 case study on writing centers, Bemer examines the ways these centers schedule appointments and the availability of online tutoring services to gauge how writing centers represent themselves and how well they identify student needs. After creating a list of one hundred college and university writing center websites, Bemer examined “how the websites discussed and allowed for scheduling online and whether schools offered online tutoring” (p. 25). She looked for specific terminology such as “walk-in,” “in person,” and “phone call,” and counted each appearance. In her discussion, she found that writing centers can learn from
usability theory by making it as easy as possible to make appointments, likely increasing the number of clients served. In order to accomplish this goal, she made two suggestions. First, she suggests that writing centers can better meet student needs by offering more ways to schedule appointments. Her second suggestion is to usability test writing center websites with their target audiences. In the end, she concludes that “designing writing center websites for identification will hopefully build and sustain student connections to keep students coming back to centers and improving as writers throughout the semester and their college careers” (Bemer, 2015, p. 27).

Wojciechowski (n.d.) also addresses the usability of writing centers in a case study but instead focuses on the usability of the management software WConline. The purpose of this research was to “study and learn how WConline is used as the SVSU’s Writing Center platform for its Online Writing Center (OWC) and appointment scheduling using the methodologies of heuristic evaluation and task analysis” (Wojciechowski, p. 10). In a cognitive walkthrough, she determined the main task of a user was signing up for online appointments and then accessing those appointments. She then broke that task into four subtasks. This breakdown was used in tandem with her heuristic evaluation to examine how the “design of WConline supported or failed to support these processes” (Wojciechowski, p. 14). Both methodologies helped her to pinpoint flaws in the WConline interface design that inhibit usability, such as the lack of clarity in the user path for scheduling and accessing appointments (Wojciechowski, p. 21).

Bemer and Wojciechowski’s studies are of two of the first instances of usability application for learning centers. This category of examination has been sluggish to develop, most likely due to the lack of cohesion in the definitions of learning centers across various campuses and the more recent appearance of specific technology to meet learning center needs. The lack of cohesion across definitions results in a lack of definitive terminology in research. For example,
When hunting for studies on learning centers, the information one is searching for could be under multiple terms, such as learning center, writing center, tutoring center, peer tutoring, academic support, etc. The appearance of specific technology for learning centers is also a more recent acquisition. For many years tutoring has been defined mainly as person to person interaction, with the biggest piece of technology utilized being the classic tools for learning, i.e. books, pencils, and paper. This new growth is evidenced by the small amount of companies present in the markets that cater to learning centers, such as TutorTrac, Accutrac, and Wconline. The continued development of technology that supports academic services, and more specifically learning centers, will only be possible with an increased emphasis on usability testing in this field. There is little research on usability testing of this type of technology, and this paper will address this issue by adding a study to the conversation.

**Nielsen’s Heuristic Principles as an Evaluation of Usability**

Usability testing has been around for quite some time, and the basic premise is fairly simple: “If you want to know whether something is easy enough to use, watch some people while they try to use it and note where they run into problems” (Krug, 2014, p. 115). There are many methods for usability testing, but one of the most common is the heuristic evaluation. Many people opt for heuristics because it is cheaper, and often referred to as the “discount” method.

Independent research (Jeffries et al. 1991) has indeed confirmed that heuristic evaluation is a very efficient usability engineering method. One of [Nielsen’s] case studies found a benefit-cost ratio for a heuristic evaluation project of 48: The cost of using the method was about $10,500 and the expected benefits were about $500,000 (Nielsen 1994). (Experience, n.d.)
This method usually involves multiple evaluators, who use a set of recognized design rules to analyze a system or product in order to pinpoint any usability problems (Jimenez, 2016). Much like the original concept of usability, this specific method was originally only applied to assessing software, but over time it has expanded into other fields and contexts, such as medical (Chan, 2012) and educational applications (Alsumait, 2009).

There are a few sets of general validated heuristics, such as Jakob Nielsen’s 10 Principles of Heuristics or Shneiderman’s Eight Golden Rules, but researchers have lately been altering these validated sets—or creating their own sets—to tailor their analysis to a specific system or product. One example of this can be seen in research done by de Almedia Pacheco et al. on Learning Objects (LOs). This study focused on building usability criteria for evaluating augmented reality for Learning Objects on Smartphones (de Almedia Pacheco, 2019). The researchers used Nielsen’s 10 principles but altered the questions to better fit the context of AR from mobile devices and LOs. They also added questions from selected criteria that were more geared toward measuring the usability of AR, Smartphones, and LOs. After compiling these criteria, they had a small sample of the target audience use the new heuristics to test an LO with known usability problems.

Eight people had access to the material and participated in the discussions fostered during the course from the concepts of usability (tests and heuristic inspection). Participants were asked to highlight issues related to the use of AR in mobile devices to increase the teaching learning process for the purpose of mapping aspects that were characteristic of such applications. (de Almedia Pacheco, 2019, p. 8-9)

They found that even though Nielsen’s heuristics are somewhat generic, they can still be adapted to evaluate more specific systems. They also noted that any gaps in the altered set of Nielsen’s
heuristics can be filled by other sets. “[The] heuristics of Nielsen are quite generic but must be re-read to fit the specifics of educational AR application and their target audience. Thus other heuristics were necessary to contemplate other aspects of this type of application.” (de Almedia Pacheco, 2019, p. 13)

For evaluations of more common technology, such as web-based applications, Nielsen’s heuristics can be used as the standard. Upon publishing *Heuristic evaluation of user interfaces* (Nielsen & Molich, 1990) and *Usability Inspection Methods* (Nielsen, 1994), Jakob Nielsen has become almost the forefather of the heuristic evaluation. “Since it was proposed by Nielsen, the set of ten usability heuristics has been the most accepted and applied set of heuristics” (Jimenez, 2016 p. 1). Nielsen’s Heuristics include the following 10 principles:

1. **Visibility of System Status** – The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.

2. **Match between the system and the real world** – the system should speak the users’ language, with words phrases, and concepts familiar to the user, rather than the system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.

3. **User control and freedom** – users often choose system functions by mistake and will need a clearly marked “emergency exit” to leave the unwanted state without having to go through an extended dialogue. Support undo and redo.

4. **Consistency and standards** – Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.

5. **Error Prevention** – Even better than good error messages is a careful design which prevents a problem from occurring in the first place. Either eliminate error-prone
conditions or check for them and present users with a confirmation option before they commit to the action.

6. Recognition rather than recall – Minimize the user’s memory load by making objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.

7. Flexibility and efficiency of use – Accelerators – unseen by the novice users- may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.

8. Aesthetic and minimalist design – Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.

9. Help users recognize, diagnose, and recover from errors – Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.

10. Help and documentation – Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user’s task, list concrete steps to be carried out, and not be too large.

From its inception in the 1980’s, usability and usability testing, have outgrown the field of the human-computer interaction. Though there are many methods for performing usability testing, heuristics is one of the most popular due to its relatively low cost. Nielsen’s heuristic principles are the most commonly referenced and widely utilized set. Their general nature makes
them easy to apply, and they can be altered or added to in order to tailor them to a specific
interface. For the purposes of this paper, Neilsen’s heuristic principles will act as the basis for
evaluating TutorTrac.
Chapter 3: Methodology

Research Design and Sampling

This study evaluates TutorTrac by using Jakob Nielsen’s (1994) 10 Principles of Heuristics for Usability Design. In this evaluation, the heuristics were applied to two groups of users: potential new users and current users. The potential new users are students with no prior knowledge of TutorTrac; they were selected to measure how difficult TutorTrac is to learn. Current users are current student employees; they were chosen to evaluate TutorTrac from the perspective of an average user who has experience with the interface.

Potential new users participated in an eye tracking study followed by a usability survey. Thirty-seven participants were recruited through two techniques. The first was for the promise of extra credit points: several professors offered a class-specific amount of extra credit points for any student who would participate in the study. The second technique was simply word-of-mouth. Any student interested in learning about eye tracking or participating could join the study if they met the requirements. The only requirement for participation was that a participant be a current Ball State Student with no prior experience working with TutorTrac. If any student came in for extra credit who did not meet these requirements, their results were not recorded for the study.

During eye tracking, these thirty-seven participants were split into two groups based on a coin flip. Both groups were seated in a lab setting on a computer capable of eye tracking, given a brief explanation of TutorTrac’s purpose, and asked to schedule an appointment for a student. Both groups were under observation by a single researcher to keep the time and ensure there were no problems accessing the post-survey. Group 1 was given the typed instructions that the
BSU LC created to train its student workers on TutorTrac, while Group 2 was given no instruction and only allowed to use whatever support TutorTrac provided within the application. Each participant was given five minutes to schedule an appointment. This time limit was based on timed experiments with current Learning Center employees, who averaged just under two minutes when performing the same task. After the five minutes were up, the researcher instructed the participant to halt their actions and ended the exercise. The participants finished their session with a post-survey based on Nielsen’s 10 Principles of Heuristics. Though the researcher observed the eye tracking sessions, they were not allowed to instruct the participants in any way. The researcher could answer a participant if they asked whether the task had been completed, but the answer had to be a simple “yes” or “no, please continue.”

The current employees were given an anonymous survey that also used Nielsen’s 10 Heuristic Principles as a basis. After approval from the Learning Center Director, the survey was put on Qualtrics and sent to every current student employee via email. This email was sent four times over the course of three weeks and yielded twenty-three participants.

**Survey Instruments**

The survey of current employees was created to measure whether TutorTrac’s usability improved with time and training. Questions 1-4 addressed characteristics of participants, including position title, length of employment, and comfort level navigating websites normally. Questions 5-14 were used to assess the usability of the TutorTrac web-based application. The questions were designed based off Nielsen’s 10 heuristic principles and address the same topics: visibility of system status, match between the system and the real world, user control and freedom, consistency and standards, error prevention, recognition rather than recall, flexibility and efficiency of use, aesthetic and minimalist design, help users recognize, diagnose, and
recover from errors, and help and documentation. Question 15 is a request for user input into what would improve the interface.

The survey for potential new users was created to measure whether TutorTrac provided adequate support for new users. Question 1 addresses the emotional impact of a user’s first experience with TutorTrac. Questions 2-9 were designed using Nielsen’s 10 heuristic principles, but without heuristics 1 and 7. Heuristic 1 is visibility of system status and heuristic 7 is flexibility and efficiency of use. It was determined that new users would not be able to give accurate evaluations for these heuristic principles, because they are both targeted toward repeat users. Question 10 is a request for user input into what would improve the interface, specifically for first time users.

**Eye Tracking Measure as Supplementary Data**

Eye tracking technology is used to examine eye movements, more specifically fixations and saccades. A fixation is when the eye rests on a particular area, and saccades are rapid movements between each fixation (Neilsen & Pernice, 2010). To track these movements, a light source is aimed at the eye, while a camera tracks the reflection of the light source and the pupil. Eye tracking can be used to supplement usability analysis to identify more specific aspects of a design for testing or improvement. “As a strategy, traditional task completion time from usability evaluations can be used to pinpoint areas for more detailed eye tracking analysis” (Goldberg & Helfman, 2010, p. 77). This study uses Tobii Pro Studio eye tracking technology, specifically heat mapping and gaze plots, to pinpoint where new users look the most and how many fixations occur before new users leave the first page.

Heat maps are the most common visualization method for eye tracking studies. “Heat maps are typically aggregated across multiple users…The color-coding represents the average
behavior for all users” (Nielsen & Pernice, 2010, p. 12). In heat maps, a screenshot shows color-coded splotches that vary in location and size according to the amount of looks each area attracts. Red areas represent where users look the most. Yellow areas represent fewer user fixations, while green areas contain the least amount of viewed space (Nielsen & Pernice, 2010). In terms of this study, a heat map will show where the majority of users fixate on the home screen as they attempt to schedule an appointment in TutorTrac. The heat map will yield insight into what specific areas of the design are drawing attention and show where redesign may be needed. An example a heat map can be seen in figure 1 below.

Figure 1. Example Heat Map

Gaze plots depict the journey of a single user’s visit to a page. Colored dots represent individual fixations. The larger a dot appears, the longer a user fixated on that area. The lines in between each dot represent saccades (Nielsen & Pernice, 2010). “Ultimately, a design needs to cater to one user at a time, and usability is determined by the success or failure of each single
user. So, there is also much to be gained from visualizing individual users’ viewing patterns” (Nielsen & Pernice, 2010, p. 12). For the purposes of this thesis, gaze plots will be used to depict how many fixations occur before new users leave the home page and start the user journey. An example of a gaze plot can be seen in figure 2 below.

Figure 2. Example Gaze Plot
Chapter 4: Results

Survey of Current Employees

The survey of current employees was designed to answer my first research question using Nielson’s heuristic principles, which focuses on the usability problems in TutorTrac. Of the twenty-three participants, eighteen were tutors and five were desk assistants. Tutors are employees who assist clients with schoolwork, and desk assistants are employees who schedule clients for appointments and keep track of attendance. I totaled the average number of times tutors and desk workers use TutorTrac each day; on average, tutoring desk assistants check TutorTrac about 79 times a day, while tutors check TutorTrac around twice a day. This statistic shows that the desk assistants are the primary users.

Each participant was asked to rate their general level of confidence while navigating websites in their daily lives. The chart in Figure 3 illustrates the level of confidence for each participant. Most of the participants feel competent while navigating websites as everyday users.

![Figure 3. Participant Self-confidence in Navigating Websites](image-url)
Heuristic 1: Visibility of System Status. When asked whether TutorTrac keeps them informed about changes or give feedback, almost 70% of participants responded that the system does not keep them informed. Of the other 30%, there were mixed responses (Fig. 4).

Figure 4. Whether TutorTrac Keeps Users Updated
13% mentioned that they had signed up to receive text updates, but there seemed to be varying degrees of success. One participant said that they did receive texts, while another said the texts are too sporadic to have reliability. A third person said that they signed up for text messages but have stopped receiving them altogether. 4.3% of participants said that they usually ask another worker to look up new information for them. Another 4.3% believed that just checking the calendar constituted as being notified. Finally, 8.7% were unsure or confused by the question.

Heuristic 2: Match between the system and the real world. When asked whether TutorTrac presents information in a logical order that is easy to understand, 65.2% of participants said yes, while 34.8% said no (Fig. 5).
Figure 5. Whether TutorTrac is Logical

Most of the “yes” answers qualified that, after a period of stress for learning the system, the layout seems logical: “Once you learn the system it is decently easy to navigate, but learning it is hard because it doesn't give you a direct way to really get anywhere.” The “no” answers seemed focused on qualifiers about the schedule/calendar feature. One participant noted that TutorTrac presented information in an orderly fashion until it comes to the schedule, which wasn’t very intuitive. “I didn't know that you could view the names of your clients by clicking on the little button next to your name until a few months ago. That would have been better if it was obvious that you could do it or if you could just see the name of your client on the main schedule page.”

**Heuristic 3: User control and freedom.** When asked whether there was an obvious undo or redo button, 87% of participants said no and 13% said yes (Fig. 6).
Figure 6. Whether TutorTrac has an Undo/Redo

**Heuristic 4: Consistency and standards.** When asked if they had ever been confused by specific terms or icons, the answers were split. 47.8% of participants said yes and 47.8% said no, while 4.4% declined to answer (Fig. 7).

![Pie chart showing 47.8% yes, 47.8% no, and 4.4% declined to answer]

Figure 7. Whether Terms and Icons are Easy to Understand

This division could mean that TutorTrac is having difficulty communicating what icons and terminology mean in a self-explanatory or self-evident way. Half of the participants remarked that they were not inconvenienced or confused by the terminology or icons in TutorTrac, which means that they were clearly able to interpret the meaning behind them. The other half of participants were confused by clickability and the purpose of certain icons. Some were unsure whether an icon was clickable, such as the trackman or the magnifying glass: “Yes, like the trac man…Why is it a trac man? We don’t know. Or the magnifying glass- that [takes] me to make appointments but that’s usually [just] a search bar.” Both of these icons are located in a small Trac Navigation box at the top of left of the TutorTrac home screen. An example of the Trac Navigation box can be seen in Figure 8, along with an example of how small the icons appear on a full screen shot in Figure 9.
Others were confused by the multiple functions of the same symbol. Specifically, participants noted that the “x” symbol that is used to permanently delete appointments in the calendar feature is the same “x” symbol that desk workers are told not to click in the student history section. One participant noted that “it is odd that there are ’x’ options by an individual's appointments, but rather than hitting them, you are supposed to use the drop down or go to the tutor's schedule.” An example of both instances of using the “x” icon can be seen below in Figures 10 and 11.
Figure 10. “x” Icon Used to Permanently Cancel a Client’s Appointment

Figure 11. “x” Icon Current Employees are Forbidden from Using
Heuristic 5: Error Prevention. When asked whether they encounter errors often, 47.8% of participants said yes and 47.8% said no. 4.4% declined to answer (Fig. 12).

Figure 12. Whether Errors are Common

This split could be attributed to user confusion as to what constitutes an error. Half of the participants believe that they encounter errors when the system does not reflect what is happening in the Learning Center. Many complained that the TutorTrac schedule says one thing, but discover the system has not updated and is incorrect when they go to the tutoring desk to pick up their clients: “There are frequent errors on who my clients are and when I have a client, especially when there are cancellations and post-pones.” The other half may attribute these inconsistencies to human error and not take into account that the system is not updating. One participant noted that “I don't think there are errors often with TutorTrac, but the way it is set up makes it easy to create human error. For example, you can accidentally schedule a tutor for two different classes at the same time. With this issue, it is up to us to notice it and maneuver the schedule.”
Heuristic 6: Recognition rather than recall. When asked whether directions for use were easy to remember or find to reference, 56.5% of participants said yes while 39.1% said no. 4.4% declined to answer (Fig. 13).

![Pie Chart](image.png)

Figure 13. Whether Directions are Easy to Understand or Find

The Learning Center provides written instructions created by the BSU administration after they were trained on TutorTrac. The distribution in the graph above could be due to participants misinterpreting the question and believing the written instructions were provided by TutorTrac rather than the Learning Center. One participant noted that “I find them fairly easy to remember…I always referred to physical information packets from [administrator] when I needed help.” The other 39.1% of participants said that they only received training from the Learning Center, and that TutorTrac did not provide any exact instruction: “If we [didn’t] get a demonstration during training, I would have no idea what to do. It's not apparent on your own.” Instead of self-solving their problems, many of them ask a supervisor or the administrator who is in contact with TutorTrac.

Heuristic 7: Flexibility and efficiency of use. When asked whether there were shortcuts to make big tasks easier, 74% of participants said no and 13% said yes. The last 13% declined to answer (Fig. 14).
Heuristic 8: Aesthetic and minimalist design. When asked whether TutorTrac displays only relevant information in an easy to interpret design, 8.7% of participants said yes while 56.5% said no. 34.8% declined to answer (Fig 15).

Most participants mentioned mystery options on the dropdown menus that ultimately confused them, because they never used them or filled them in: “There is unrelated information sometimes, such as on the general profile of a student, or the feature under the glass saying ‘consultant listing.’ Also, for my position at least, I don't utilize all of the options under the TutorTrac man scroll down option either.”
Heuristic 9: Help users recognize, diagnose, and recover from errors. When asked whether TutorTrac alerts users of errors and clearly explains their cause, 69.6% of users said no and 13% said yes. 17.4% declined to answer (Fig. 16). Again, there was some confusion due to the lack of communication on TutorTrac’s part, but the majority of participants were sure that they had never encountered an error message. One participant said “Not really. I'm not sure if there's ever been an error, but it's never said so.”

Figure 16. Whether there are Specific Error Messages

Heuristic 10: Help and documentation. When asked whether TutorTrac provides written instruction or problem-solving techniques to assist with user confusion, 82.6% of participants said no, while only 4.4% said yes. 13% declined to answer (Fig. 17).
Figure 17. Whether there is a Help Option

**Suggestions for improvement.** The final question asked participants how they would make TutorTrac better. Most of the participants requested an updated calendar design, specifying that it be “easier” to read. Many of them also suggested redesigning the entire front end of the interface, which would increase the usability. The breakdown of the rest of the suggestion can be seen in Figure 18 below.

![Figure 18. Suggestions to Improve TutorTrac](image)

**Survey of Potential New Users**

The survey of potential new users was also used to answer my first question using Nielsen’s heuristic principles, which focuses on the usability problems in TutorTrac. Due to the fact that participants from this sample are first time users, it was determined that they would not be able to give accurate evaluations for heuristic principles 1 (the visibility of system status) and 7 (flexibility and efficiency of use) It was determined that novice users are unlikely to
comprehend accelerators, as they are focusing on learning how the interface works rather than shortening tasks. The results of this survey instead focus on asking about heuristic principles 2, 3, 4, 5, 6, 8, 9, and 10, as well as two questions about the user path and user experience.

To answer my second research question, which aims to understand how users feel when they interact with the system for the first time, I also included questions about their emotional responses. When asked how they felt during the scheduling task, participants provided a range of emotional responses. Most of the participants felt negative emotions, with the majority feeling confused. The breakdown of the different emotions can be seen in Figure 19 below.

![Figure 19. Emotional Response to TutorTrac Scheduling Task](image)

**Heuristic 2: Match between the system and the real world.** When asked whether TutorTrac presents information in a logical order that is easy for you to understand 86.5% of participants said no, while 13.5% said yes (Fig. 20). The participants mainly seemed confused
about navigation because there was no order or focal point to guide them: “I felt like the information was all over the place and didn't give me a clear task of what to do on the website.” They mentioned that the user path was not “intuitive.” One participant even likened the experience to an “escape room without hints,” while another described the experience as “extremely obscure and not detailed…it felt like a puzzle.”

Figure 20. Whether TutorTrac is Logical

**Heuristic 3: User control and freedom.** When asked whether there is an obvious undo, redo, or return button if the user accidentally clicks the wrong thing, 86.5% of participants said no, while 13.5% of participants said yes (Fig. 21). Many participants were scared by the lack of a return button and were nervous about making a mistake: “I tried not to make a mistake because I was afraid I wouldn't be able to go back so I didn't really notice how hard it would be to figure this out or not.” Others tried to find one if they messed up, but generally just continued and accepted making a mistake if they messed up. “I don't think so? I ended up scheduling two appointments.”
Heuristic 4: consistency and standards. When asked whether icons and terminology were easy to understand or interpret, 64.9% of participants said no while 35.1% said yes (Fig. 21). The participants were most often confused because the terminology was not self-evident or self-explanatory: “The terminologies were very confusing. Some of them didn't match what I had in my head.” Another frequently noted aspect was that the icons and font were too small, which made them difficult to read and understand. One participant noted that “I was just really confused where to find everything because everything was so small and hard to read.”

Heuristic 5: Error Prevention. When asked which steps in the scheduling task were difficult and why, participants listed various design flaws. 81.4% cited that there was no clear
user path or direction. 18.9% of participants thought there was too much information to sort through. 10.8% said that terms, icons, and buttons were not clearly visible. 5.4% said that when they filled out the information wrong, there was no direction on how to correct the error. 13.5% listed various points unrelated to the scheduling path because they were so confused by the procedure that they never made it to the correct first step (Fig. 23).

![Pie chart showing user feedback]

Figure 23. Why the Scheduling Task is Difficult

**Heuristic 6: Recognition rather than recall.** When asked whether directions for use were easy to remember or find to reference, 78.4% of participants said no while 21.6% of participants said yes (Fig. 24). Participants reported that they searched but were unable to find the assistance they needed: “No, I did not see assistance or directions and I was looking for the right words most of the time.” Many of them clarified that they would like the directions to be distinguishable and easier to find. One participant suggested that “the directions need to be more clear and labeled.”
Figure 24. Whether Directions are Easy to Find or Reference

**Heuristic 8: Aesthetic and minimalist design.** When asked whether TutorTrac displays only relevant information, 40.6% of participants said no while 27% of participants said yes. 32.4% were unsure (Fig. 25).

Figure 25. Whether there is Only Relevant Information

In this question, the majority of participants said that TutorTrac did not display only relevant information, but the split was quite close. This could be due to the nature of the experiment. This was the first time that any of the participants were exposed to TutorTrac, and it was a timed task. Each participant was looking for specific information to complete the task and was likely only skimming each page for buzzwords. For example, one participant said “there was a lot of
information presented, but I am not sure whether they were irrelevant because I was focusing on the information listed on the instructions.”

**Heuristic 9: Help users recognize, diagnose, and recover from errors.** When asked whether TutorTrac alerts the user of an error and clearly suggests a solution, 35.1% of participants said yes, while 29.8% said no. 35.1% said they did not know or were unsure (Fig. 26).

![Figure 26. Whether there are Specific Error Messages](image)

This almost even three-way split could be attributed to lack of knowledge about error messages in the system. The participants mainly seemed confused because they didn’t know what constituted an error message. Participants that believed TutorTrac had error messages alongside its success messages and, assuming they had made an error, TutorTrac would have told them: “When I submitted it there were red words that assured that I did so I'm assuming it would be similar if there was an error.” Participants that believed TutorTrac did not have an error message were pretty sure it didn't because one never popped up during their experience. One participant stated “I didn't get an alert when there was an error, so I don't believe it does.” The remaining participants were merely confused by the concept of error messaging, as some of the terminology in TutorTrac seemed negative but may not represent error on the part of the user: “I'm not
certain. I know I was told that there were no available slots for the information I entered, but it did not specify it as an error, more so that there were just no slots available.”

**Heuristic 10: Help and documentation.** When asked whether TutorTrac provides written instruction or problem-solving techniques when users are confused by a task, 81.1% of participants said no, and 8.1% said yes. 10.8% were unsure (Fig. 27). Some participants felt completely lost: “I was pretty much helpless with no instructions or directions.” Many underscored that they tried to make educated guesses throughout the whole experience but still couldn’t figure it out. One participant said “it felt like a guessing game of where things would be located and the steps I needed to take.”

![Figure 27. Whether there is a Help Option](image)

**Suggestions for improvement.** When asked how the scheduling experience could be made easier or more satisfactory, participants supplied a range of ideas. Most participants suggested improving the design would increase usability. There were also a notable number of requests for a more clearly marked user path, or at least instructions for following the path. The breakdown of the suggestions is in Figure 28 below.
Eye Tracking

**Group 1 Task Completion.** Only two participants from group 1 were able to complete this task. Group 1 contained eighteen participants, which means that only 11.1% of group 1 was able to complete the task, even with the LC instruction.

**Group 2 Task Completion.** No participants in group 2 were able to complete this task, which was made up of nineteen participants. 0% of group 2 were able to complete the scheduling task using only the TutorTrac interface.

The heat maps depict the amount of time participants spent attempting to move beyond the home screen during the scheduling task and specifies where the participants are fixating on the screen. Red spots represent the highest areas of fixation. On average, group 2 participants spent more time on the home screen than participants from group 1. 94% of group 2 depicts intense fixation for longer periods of time. Participant’s attention was also distributed across a greater amount of the home screen, which can be seen in the increased presence of splotches and
their wider dissemination. The majority of group 2 participants spent more time fixating on the center of the TutorTrac home screen. Very few looked to the upper left side of the screen, which is where the menu and link to the appointment making screen are located. The heat maps can be found in the appendix.

Group 1, the participants who were given instructions, overall spent considerably less time navigating the home screen. For the purposes of the heat mapping section, participant C14 was not included due to a malfunction with the eye tracking software. The difference between the heat maps from group 1 and group 2 is significant. Only 35% of the group 1 heat maps show intense fixation for a longer duration, compared to 94% in group 2. Group 1 also shows a smaller distribution of the splotches across the screen, the participants in this group quickly finding their way to the upper left of the screen and moving to the next phase of the scheduling task.

From these heat maps, one can see that without instruction or guidance new users struggle with the TutorTrac design. Participants with instruction spent less time searching for the menu and link that took them beyond the homepage. Participants without instruction spent more time searching the home screen, often focusing on the middle of the screen, which will not help them navigate further. This could mean that the TutorTrac design is not strong enough by itself to meet new users’ needs without instruction, as it’s pulling user focus toward the center of the screen rather than directing users to the menu.

The results of the gaze maps further show a different viewing pattern between group 1 and group 2. For the purposes of the gaze plot section, participant C14 (group 2) was not included due to a malfunction with the eye tracking software. Gaze plots portray fixations and saccades with dots and lines. The dots represent the fixation, with larger dots shows longer durations of time spent looking in one particular spot. The connecting lines show the saccades.
Each dot is numbered to indicate the path the user’s eyes take across the screen. Participants in group 1 showed significantly less fixations and less eye movements than participants in group 2. Group 1 also depicted a smaller area of interest than group 2, meaning that group 2 participants fixated in many different places all over the screen and group 1 participants usually fixated on only one or two areas. Figure 29 illustrates the user path from a participant in group 1, while figure 30 demonstrates the user path from a group 2 participant.
The average number of fixations for group 1 was 47.1. The average number of fixations for group 2 was 279.6. Table 2 below depicts the number of fixations for each participant.

Participants labeled with C numbers are from group 1 and participants labeled with E numbers are from group 2.

Table 2.
Number of Fixations in Gaze Plot

<table>
<thead>
<tr>
<th>Participant</th>
<th>Number of Fixations</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1</td>
<td>145</td>
</tr>
<tr>
<td>C1</td>
<td>66</td>
</tr>
<tr>
<td>E2</td>
<td>31</td>
</tr>
<tr>
<td>C2</td>
<td>24</td>
</tr>
<tr>
<td>E3</td>
<td>113</td>
</tr>
<tr>
<td>C3</td>
<td>15</td>
</tr>
<tr>
<td>E4</td>
<td>232</td>
</tr>
<tr>
<td>C4</td>
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</tr>
<tr>
<td>E5</td>
<td>703</td>
</tr>
<tr>
<td>C5</td>
<td>22</td>
</tr>
<tr>
<td>E6</td>
<td>813</td>
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<td>695</td>
</tr>
<tr>
<td>C8</td>
<td>8</td>
</tr>
<tr>
<td>E9</td>
<td>80</td>
</tr>
<tr>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>C9</td>
<td>22</td>
</tr>
<tr>
<td>E10</td>
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</tr>
<tr>
<td>C10</td>
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</tr>
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<td>E11</td>
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</tr>
<tr>
<td>C11</td>
<td>19</td>
</tr>
<tr>
<td>E12</td>
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<tr>
<td>C12</td>
<td>142</td>
</tr>
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<td>E13</td>
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</tr>
<tr>
<td>C13</td>
<td>11</td>
</tr>
<tr>
<td>E14</td>
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<tr>
<td>C14</td>
<td>Not included due to eye tracking equipment malfunction</td>
</tr>
<tr>
<td>E15</td>
<td>108</td>
</tr>
<tr>
<td>C15</td>
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<td>E16</td>
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</tr>
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<td>E19</td>
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</tr>
</tbody>
</table>
Going by individual participants, one can see that the group 2 participants spent significantly more time on the first step of the user path, or the first page of the TutorTrac home screen. This meant that they wasted more time during the five minutes allocated to them for the scheduling task, than participants in group 1. Ultimately, a design must cater to individual users, and usability is determined by the success or failure of each single user. Even though the majority of both groups failed the scheduling task in the time allotted, all of the participants in group 1 spent less time stuck on one particular task. This is most likely due to the advantage group 1 had in instruction, which means that TutorTrac would be slightly more successful with available instruction.
Chapter 5: Discussion

The TutorTrac system has been used at BSU for years, but usability testing among both current and potential new users has revealed some weaknesses with the interface. The majority of current users requested change in multiple areas, while some even stated that the BSU LC should move to a different software provider. New users were mostly confused and frustrated by the system. When given a task to perform, all but two of the thirty-seven failed to finish in twice the time it takes a current user. The research from these studies can best be summed up in three major areas for improvement: user assistance and addressing user needs, user interface redesign, and user emotions reflecting the user experience. By focusing on implementing the first two areas, one can address the third. The below suggestions are in answer to the first question posed in this study: what are the usability problems in TutorTrac?

User Assistance and Addressing User Needs

Facilitating open communication with the users. Most of the current users said that TutorTrac does not alert them when there are modifications or when the system has booked a client. Some stated that they signed up to receive text messages about client cancellations, but most of these participants also noted how unreliable these texts were. This harkens back to Nielsen’s first principle: Visibility of System Status. It states that a system should always keep users informed with appropriate feedback in a reasonable time. TutorTrac should start communicating more effectively with their users via text, email, and popup notification so they know about updates or changes that may affect their daily routine. TutorTrac can also use open communication as an opportunity to inform users about changes or updates to the TutorTrac design and point out features that are receiving little use. This will cut down on confusion about TutorTrac’s capabilities and make the site more transparent and user friendly.
Creating a clear and concise error message that explains the issue. An example of an error message should be presented to new users when they first begin using the system, so they know what an error message constitutes. Both current and new users mentioned they were confused on this subject because they didn’t know how an error would look if it appeared. This relates to Nielsen’s fifth principle: Error Prevention. It states that a system should check conditions for a user and present them with a confirmation option before they commit to an action. Providing an error message is especially important, because error alerts keep users on the user path by warning them if they are straying.

Providing instruction that is easy to find or reference. This seemed to be one of the most prominent areas of confusion in this study. In the sample of current users, participants were unsure whether the guidance they had been given came from TutorTrac or the BSU LC. Many of the current users cited that they used written instructions when they were learning the system. Other users mentioned that they would be lost without training and demonstrations from BSU administrators. Neither of these resources are provided by TutorTrac, and the disconnect between instruction and software design is evident in the eye tracking study.

In the sample of potential new users, the instructions provided by the BSU Learning Center seemed to only confuse participants. Only two participants out of thirty-seven were able to complete the scheduling task. The eye tracking sample was split into two groups; group 1 consisted of eighteen participants who were given the instructions created by the BSU LC, and group 2 was made up of nineteen participants, who were told to try and figure out how to schedule an appointment using just TutorTrac. Only two participants, both from group 1, were able to complete the scheduling task. This means that sixteen out of eighteen users were unable
to perform the task even with instruction. This also means that the all of the participants in group 2 (nineteen) was unable to navigate TutorTrac by itself.

The heat mapping and gaze plot models showed that group 2 spent considerably more time searching for the user path than group 1. Without instruction, group 2 relied solely on the TutorTrac design as a guide. Group 2 fixated largely on the center of the TutorTrac home screen. This means that the design was focusing the users on wrong section of the application, and not providing enough support to direct the user to the correct user path.

TutorTrac can address these issues with current and new users by providing detailed instruction on how to operate the interface. This relates back to Neilsen’s sixth and tenth principles. Principle 6 is recognition rather than recall, which states that a system should minimize a user’s memory load by either making all actions or options visible or providing easily retrievable instructions. Principle 10 is help and documentation, which posits that it may be necessary to provide easily accessed help and documentation for users. By offering a manual or instruction page, TutorTrac makes the learning process easier on new users and allows experienced users a place to reference if they run into an error message. These should be easy to access, so that users can find support whenever necessary.

**Providing a place to seek help when diagnosing errors.** This is an extension to providing error messages and instructions for use. It relates back to Neilsen’s ninth principle: help users recognize, diagnose, and recover from errors. This rule articulates that error messages should plainly state the problem and suggest a solution or a path to find a solution. If users cannot figure out how to do something through navigating a page or checking the directions, then they should be able to look for additional guidance from TutorTrac tech support. This can take
the form of a help button on an error message, direction toward a personnel contact box, or even a live chat.

**User Interface Redesign**

**Redesigning TutorTrac with an emphasis on visual hierarchy.** Many of the current users who said the system was logical qualified that it only seemed that way after a period of stress when learning the system. New users confirmed this novice bewilderment by requesting a more intuitive design to make the scheduling task easier. By redesigning the frontend of TutorTrac to follow real-world conventions and organizing the information in a natural and logical order, TracSystems can alleviate the stress that comes with learning the new system. Information can be balanced in design by using visual hierarchy to create an order of relevance. Visual hierarchy is the arrangement of elements in a design, which implies importance. A user’s attention will be drawn to the element that appears most important first and will continue on through the design based on descending levels of significance. Designers can influence a user’s perception of information by altering design elements such as size, color, contrast, alignment, repetition, proximity, whitespace, and texture.

During this study, the eye tracking depicted high levels of participant confusion on the homepage. There were no elements highlighting the two drop down menus in the top left of the page, and thus only the participants with instruction were able to find them. There were also no directional elements guiding a viewer’s eyes, so there was no optimal way for the user to deduce the user path without instruction. The heat mapping and gaze plots revealed that the highest level of concentration for users appeared to be in the center of the screen, an area which lacked any form of written instruction or directional assistance to guide the user to the user path. A redesign of TutorTrac with an emphasis on visual hierarchy might start by adding an element in the center
to act as an entry point. An entry point is the focal point that first attracts a viewer in a design. From this point, a designer can add directional elements which lead the user to the user path. A more functional home page for TutorTrac could look like Figure 31 below.

Figure 31. TutorTrac with Visual Hierarchy

The largest and most colorful element is the background photo, which acts as the entry point for viewers. It’s subject, the girl on the computer, draws the viewer’s attention to the center of the page, and connects it to the “Welcome to TutorTrac” text. This element holds the second highest level of importance because it is the largest group of text and the second largest element on screen, as well as being a contrasting color to darker background. English readers naturally read left to right and from the top down, so the element with the next highest level of significance is the red “Schedule Appointment” button. Though the text is smaller than the text on the menu bar, the pop of color draws the eye as viewers read through the larger text above. These elements have already laid out the user path for the most common function of TutorTrac in the BSU LC, which is scheduling appointments. A user would most likely be using TutorTrac for that purpose,
however, if scheduling a new appointment was not the intention, their eyes can easily move through these motions and then be drawn to the pop of color at the top right of the screen. The red shape in the right corner confirms to the user that they are on the BSU TutorTrac profile and leads their eyes to the menu bar which contains other functions of the software, including a “Help” option for more instruction. With this system, even if a user did not deduce the scheduling option from the clearly laid out user path, they would most likely be able to navigate using the “Help” option. The horizontal light menu bar is a common feature in website design today, adding the familiarity that puts users at ease and giving them the confidence to continue navigating.

This suggestion for frontend redesign is based on Neilsen’s second principle: Match between the system and the real world. It posits that a system should be designed in such a way that it already seems familiar to users, which can be done by following real-world conventions that put information in an order users see as natural.

**Removing irrelevant information and redesigning with minimalism in mind.** Current users mentioned that there was too much information that is irrelevant to their daily tasks on multiple screens. New users were unfamiliar with TutorTrac and split on this subject. Many stated they were unsure whether the information is relevant to other tasks they are unaware of. However, the majority still stated that for the scheduling task, the design had too much clutter. This relates to Neilsen’s eighth principle: Aesthetic and minimalist design. When there is unnecessary or rarely needed information present, it crowds the screen by competing with the relevant information and thus weakens visibility. TutorTrac can address this by eliminating information that is either unused or rarely used. The design from the earlier section showed a more minimalist approach by eliminating the clutter on the left side of the home screen and
narrowing down the menu options into the general categories of “Home,” “Appointments,” “Calendar,” “Reports,” and “Help.” Another way to limit the amount of information on screen, would be to create separate pages for different users. Upon arrival to the home screen, they could select their position and be led to a page that held their own specific menu bar. This can be seen in the Figure 32 below.

![Welcome to TutorTrac](image)

Specified categories for each employee position

Figure 32. TutorTrac Organized by Position

Another option is to use a condensed menu, such as the hamburger menu. They take up less space than the light bar menu, and also give more room for extended options by utilizing hidden menu bars. Figure 33 and Figure 34 depict how TutorTrac could appear with a hamburger menu on the home screen.
Figure 33. TutorTrac Hamburger Menu

Figure 34. TutorTrac Hamburger Menu Side Bar
One of the above suggestions would successfully eliminate the excess information on screen and increase visibility for both new and returning users. TutorTrac should consider altering their design to incorporate more minimalist elements.

**Adding a clearly marked or defined undo or redo button for users.** Both current and new users stated that if there was a clearly marked exit, they did not or could not find it. This comes from Nielsen’s third principle: user control and freedom. It states that users often choose a function by mistake and need a clearly marked exit to eject from technological mistakes. Once they become aware that they are no longer following the correct user path, they need a way to backtrack and try to fix their blunder.

**Making icons and terms self-explanatory or self-evident without repeats.** Current users wondered which items were clickable or lead to other tasks, such as the trackman, the magnifying glass in the search bar, and the calendar icon. New users were just confused and unsure about what an icon or term represented. Many of them found it difficult to complete their scheduling task due to lack of knowledge on which icon to click. This suggestion comes from Nielsen’s second and fourth principles. The second principle is the match between the system and real world, which posits that a system should speak the users’ language, with words phrases, and concepts familiar to the user. The fourth principle is consistency and standards. It argues that users should not wonder whether different situations or actions mean the same thing. To adhere to the second principle, TutorTrac should not use jargon or TutorTrac specific terms, but rather words that are familiar or at least easy for the user to interpret. To satisfy the fourth principle, TutorTrac should not duplicate icons unless they have the same outcome. If you use the same symbol for more than one function, it will confuse users, as was the case with the “x” icon.

**User Emotions and User Satisfaction**
The content from the first two sections contains suggestions for improving the usability of TutorTrac, which will in turn enhance the user experience. This brings us to the second question presented in this study: what emotional impact does TutorTrac have on new users? When asked to describe their experience, the majority of new users felt negative emotions, including confusion, frustration, anxiety, and stress. These undesirable emotions can be seen in the low number of participants who completed the assigned scheduling task. Only two out of thirty-seven were able to perform the task. According the survey data, this mass failure can be attributed to the poor interface design and the lack of assistance for users. By focusing on addressing user needs and redesigning the interface to illicit a satisfactory user experience, TutorTrac can transform the emotional impact of this user journey into a positive one.

Conclusion

Learning center management software contributes to the success of academic support services by increasing the speed of the scheduling process, helping to organize and communicate schedules to both employees and student clients, and generating data for in depth report building. All of this allows learning centers to run more efficiently and service more clients. It is thus reasonable to promote the development of learning center management software to support these services and increase academic support for students. In order to improve this type of technology, it is necessary to evaluate and ensure that a system is effective at meeting a user’s needs in both a timely manner and in a way that leaves the user satisfied with the experience.

Regarding the first question introduced in this study, TutorTrac has many usability issues, which means that the entire system needs a redesign on the front end with an emphasis on visual hierarchy to help users more easily navigate the site. With this redesign, TutorTrac should add an undo button, an error message, and make icons and terminology self-explanatory or self-evident.
They should also provide a guidance service, whether it be a contact box, an online chat, or a
help button. This should go hand in hand with clear directions for use. Finally, TutorTrac should
communicate with its users. Merely designing a software based on the desires of a client is not
enough. TutorTrac, as a software designer, must anticipate what issues or poor experiences the
user will have through extensive usability and user experience testing, and then seek to address
those needs before handing off the software to the client. “By incorporating evaluation methods
such as usability testing or heuristic evaluation throughout an interactive design process, it
becomes possible to create products and services that are useful and usable and possibly even
enjoyable.” (de Almeida Pacheco, 2019 p. 3)

Regarding the second question asked in this study, for first time users TutorTrac elicits
negative emotions. New users feel confused, anxious, and stressed when trying to perform a task
on the interface. The best way to change this outcome is to redesign TutorTrac in a way to make
the user experience more satisfactory. This can be done by focusing on the suggestions derived
from Nielson’s 10 heuristic principles.

TutorTrac needs to improve the user experience by making tasks more intuitive or easier
for users to learn. This will assist in creating a more positive emotional impact for new users.
Ultimately, this entire study can be summed up with one phrase: design with users in mind.
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Appendices

Appendix A: Survey of Current Users

1. What is your position at the Learning Center?
2. How long have you held this position?
3. On a scale of 1-9 (1 being the least and 9 being the most) how comfortable do you feel navigating most websites?
4. How many times do you interact with TutorTrac during a typical day?
5. How does TutorTrac keep you informed of changes or updates?
6. Does TutorTrac present information in a logical order that is easy for you to understand?
   Why or why not?
7. Is there an obvious undo, redo, or return button if you accidentally click the wrong thing?
8. Are you ever confused by what specific terminology or icons represent? If so, please give an example.
9. Do you encounter errors often? If so, how does the system help you correct those errors?
10. Are directions for use easy to remember, or does TutorTrac make them easy to find and reference?
11. Are there shortcuts for big tasks that make them both faster and easier to complete?
12. Does TutorTrac display only relevant information or is there unrelated information presented on some screens?
13. Does TutorTrac let you know when there is an error and does it explain the error clearly?
14. Does TutorTrac provide assistance in the form of written instruction or problem solving techniques when you need help doing a task?
15. If you could change TutorTrac in any way, would you? What changes would you make?

Appendix B: Survey of Potential New Users

1. How did the scheduling experience make you feel? Why?

2. Does TutorTrac present information in a logical order that is easy for you to understand? Why or why not?

3. Were the icons and terminology easy to understand? If not, please give an example.

4. Are directions for use easy to remember, or does TutorTrac make them easy to find and reference?

5. Is there an obvious undo, redo, or return button if you accidentally click the wrong thing?

6. What steps in the scheduling task were difficult? Why?

7. Does TutorTrac display only relevant information or are there pages with irrelevant information? Can you give an example?

8. Does TutorTrac let you know when there is an error and does it explain the error clearly?

9. Does TutorTrac provide assistance in the form of written instruction or problem solving techniques when you need help doing a task?

10. How would you make this experience easier or more satisfactory?

Appendix C: Heat Maps

Group 1 (participants with instructions)
Group 2 (participants without instructions)